

APRIL 1937

ASTOUNDING

STORIES



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SS ROCKLYNNE
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HAS AN OUNCE OF
SEX APPEAL**



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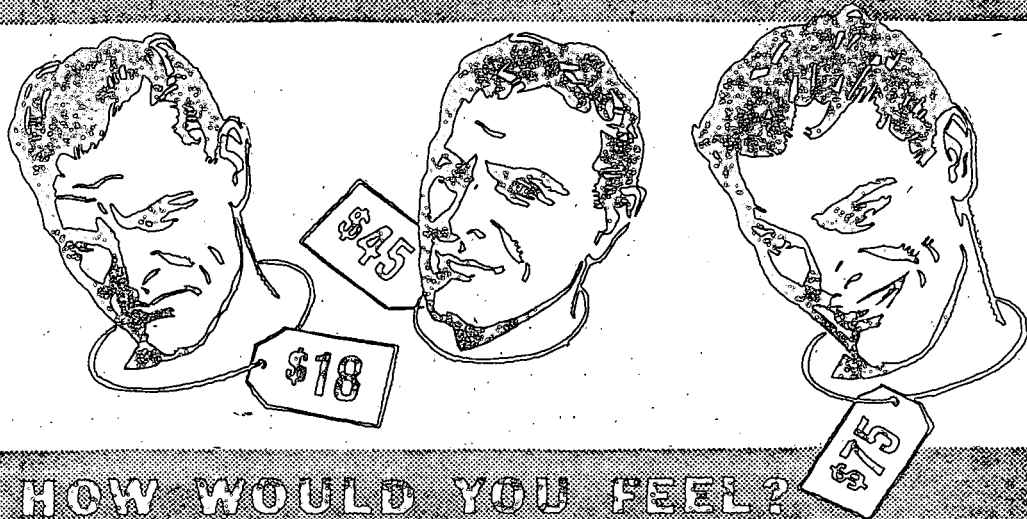
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VOLUME XIX
Number 2

ASTOUNDING STORIES

APRIL
1937

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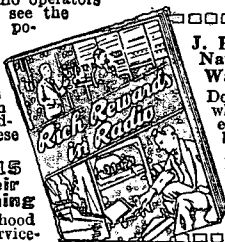
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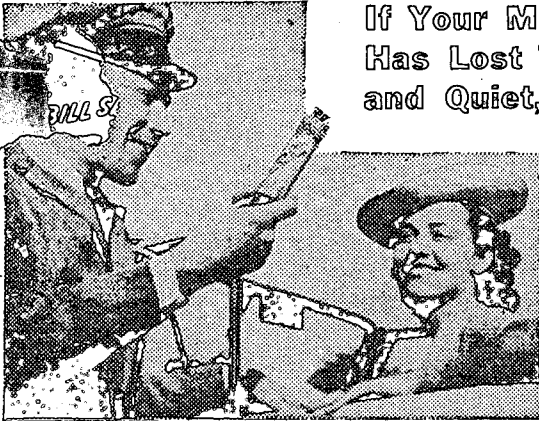
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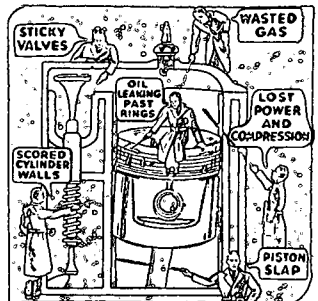
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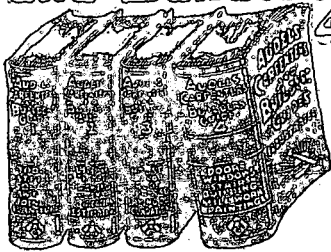
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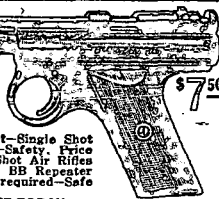
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28x4-20-51	\$2.35 \$0.85	30x3-46	\$2.35 \$0.75
28x4-20-52	\$2.35 \$0.85	30x3-47	\$2.35 \$0.75
28x4-20-53	\$2.35 \$0.85	30x3-48	\$2.35 \$0.75
28x4-20-54	\$2.35 \$0.85	30x3-49	\$2.35 \$0.75
28x4-20-55	\$2.35 \$0.85	30x3-50	\$2.35 \$0.75
28x4-20-56	\$2.35 \$0.85	30x3-51	\$2.35 \$0.75
28x4-20-57	\$2.35 \$0.85	30x3-52	\$2.35 \$0.75
28x4-20-58	\$2.35 \$0.85	30x3-53	\$2.35 \$0.75
28x4-20-59	\$2.35 \$0.85	30x3-54	\$2.35 \$0.75
28x4-20-60	\$2.35 \$0.85	30x3-55	\$2.35 \$0.75
28x4-20-61	\$2.35 \$0.85	30x3-56	\$2.35 \$0.75
28x4-20-62	\$2.35 \$0.85	30x3-57	\$2.35 \$0.75
28x4-20-63	\$2.35 \$0.85	30x3-58	\$2.35 \$0.75
28x4-20-64	\$2.35 \$0.85	30x3-59	\$2.35 \$0.75
28x4-20-65	\$2.35 \$0.85	30x3-60	\$2.35 \$0.75
28x4-20-66	\$2.35 \$0.85	30x3-61	\$2.35 \$0.75
28x4-20-67	\$2.35 \$0.85	30x3-62	\$2.35 \$0.75
28x4-20-68	\$2.35 \$0.85	30x3-63	\$2.35 \$0.75
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28x4-20-70	\$2.35 \$0.85	30x3-65	\$2.35 \$0.75
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28x4-20-74	\$2.35 \$0.85	30x3-69	\$2.35 \$0.75
28x4-20-75	\$2.35 \$0.85	30x3-70	\$2.35 \$0.75
28x4-20-76	\$2.35 \$0.85	30x3-71	\$2.35 \$0.75
28x4-20-77	\$2.35 \$0.85	30x3-72	\$2.35 \$0.75
28x4-20-78	\$2.35 \$0.85	30x3-73	\$2.35 \$0.75
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28x4-20-82	\$2.35 \$0.85	30x3-77	\$2.35 \$0.75
28x4-20-83	\$2.35 \$0.85	30x3-78	\$2.35 \$0.75
28x4-20-84	\$2.35 \$0.85	30x3-79	\$2.35 \$0.75
28x4-20-85	\$2.35 \$0.85	30x3-80	\$2.35 \$0.75
28x4-20-86	\$2.35 \$0.85	30x3-81	\$2.35 \$0.75
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28x4-20-88	\$2.35 \$0.85	30x3-83	\$2.35 \$0.75
28x4-20-89	\$2.35 \$0.85	30x3-84	\$2.35 \$0.75
28x4-20-90	\$2.35 \$0.85	30x3-85	\$2.35 \$0.75
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28x4-20-93	\$2.35 \$0.85	30x3-88	\$2.35 \$0.75
28x4-20-94	\$2.35 \$0.85	30x3-89	\$2.35 \$0.75
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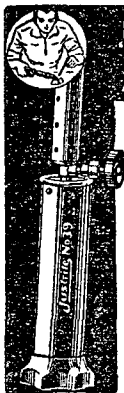
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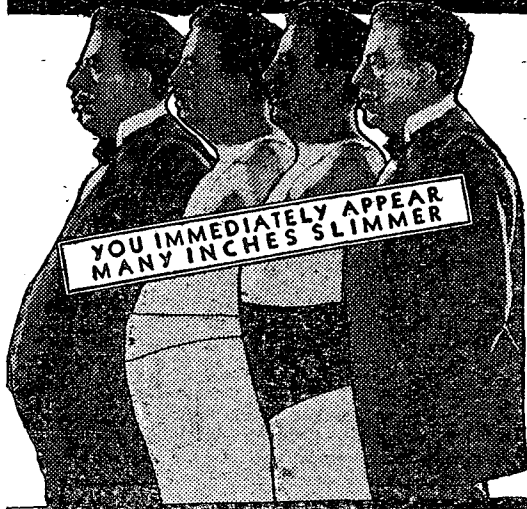
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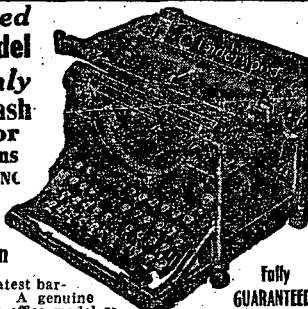
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B. Max Mehl paid Mr. Brounler of Georgia \$1000.00 for this coin that he found while digging - **DO YOU WANT BIG MONEY for OLD COINS-BILLS-STAMPS?**

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I paid \$400.00 to Mrs. Dowdy of Texas, for one Half Dollar; J. D. Martin of Virginia \$200.00 for a single Copper Cent; Mr. Manning of New York, \$250.00 for one Silver Dollar. Mrs. G. F. Adams, Ohio, received \$740.00 for a few old coins. I will pay highest cash prices for all kinds of old coins, medals, and stamps.

I WILL PAY \$100.00 FOR DIME! 1894 "S" Mint; \$50.00 for 1913 Liberty Head Nickel (not Buffalo) and hundreds of other amazing prices for coins. Send 4c for Large Illustrated Coin Folder and further particulars. It may mean much profit to you. Write to **B. MAX MEHL, 339 West Bldg., FORT WORTH, TEXAS.** (Largest Rare Coin Company in U. S. A.) Established 36 Years.

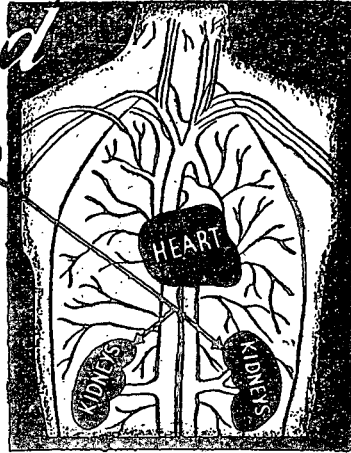
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Acids in Blood-

must be removed by Kidneys

Or your system
is poisoned



Your Health Is Undermined And
You May Suffer From Nervous-
ness, Circles Under Eyes,
Lack of Vitality, Getting Up Nights, Dizziness, Leg
Pains, and Feel Tired, Run Down, and Worn Out

There is nothing that can so quickly undermine your health, strength, and energy, as an excess of acid in your blood. Most people when thinking of Acidity think of the stomach. However, the type of acidity that undermines health is that arising in the blood and often caused by worry, overwork, fear, late hours or over-indulgence, thus placing a heavy strain or load on the kidneys.

Nature has provided an automatic method of getting rid of these excess Acids in the blood. This is accomplished by your Kidneys, the most intricate and delicate organs in your body. Each kidney, although only the size of your clenched fist, contains 4½ million tiny, delicate tubes or filters. Your blood circulates through these tiny filters 200 times an hour, or so frequently that in a 24-hour period the kidneys actually filter and purify a barrel of blood, so that the Acids and poisonous wastes may be removed.

Causes Many Troubles

Dr. Walter R. George, many years Health Commissioner of Indianapolis, recently stated: "Modern foods and drinks, nervous strain, worry, and overwork, place a tremendous load on the kidneys. For this reason, it is estimated that millions of men and women at times are troubled with poorly functioning kidneys. In fact this condition is often the real cause of thousands of people feeling older than they should, run-down, exhausted, nervous, and worn out."

If your kidneys slow down and do not function properly and fail to remove approximately 2 pints of Acids, Poisons, and liquids from your blood every twenty-four hours, then there is a gradual accumulation of these Acids and Wastes, and slowly but surely your system becomes poisoned. Kidney dysfunctions often may cause many troublesome conditions, such as Nervousness, Getting Up Nights, Leg Pains, Dizziness, frequent Colds and Headaches, Rheumatic Pains, Swollen Joints, Circles under Eyes, Backaches, Loss of Vitality, Burning, Itching, and Smarting, Acidity.

Help Kidneys Doctors' Way

Druggists and doctors in thirty-five countries throughout the world think that the right way to help your kidneys function is

with the doctor's prescription Cystex, which is scientifically prepared in accordance with the requirements of the United States and British Pharmacopoeia to act directly on the kidneys as a diuretic. For instance, Dr. C. Van Straubenzee, noted European physician, stated: "I consider Cystex one of the most meritorious formulas I have ever examined, and recommend it most highly." And Dr. C. J. Roberts, formerly of the Philadelphia General Hospital, states: "In my years of practice I have employed many medicines and prescriptions to improve the functional action of the kidneys, but in my opinion there is no preparation that excels the prescription known as Cystex." Positive proof of the merit of Cystex is in each package, which contains a complete list of ingredients, so that you can know what you are taking and be told by your doctor or druggist that Cystex is a medicine in which you can place the utmost confidence.

Make This 8-Day Guaranteed Test

If you are rundown, worn out, feel older than you are, or suffer from the conditions previously mentioned, poorly functioning kidneys may be the real cause of your trouble. At any rate it will do you no harm to put Cystex to the test and see exactly what it can do in your particular case. Under the guarantee, in 8 days' time it must do the work to your complete satisfaction, or you merely return the empty package, and the full purchase price is refunded without question or argument. With Cystex there is no long waiting for results, because it is scientifically prepared to act directly on the kidneys as a diuretic. For that reason, most people report a remarkable improvement within the first forty-eight hours and complete satisfaction within 8 days. In testing Cystex, you are the sole judge of your satisfaction. You must feel younger, stronger, and better than you have in a long time—you must feel that Cystex has done the work thoroughly and completely, or you merely return the empty package and it costs you nothing. Cystex costs only 3c a dose at druggists, and as the guarantee protects you completely, you can not afford to take chances with cheap, inferior, or irritating drugs or any medicine that is not good enough to be guaranteed. Telephone your druggist for guaranteed Cystex (pronounced Siss-tex) today.

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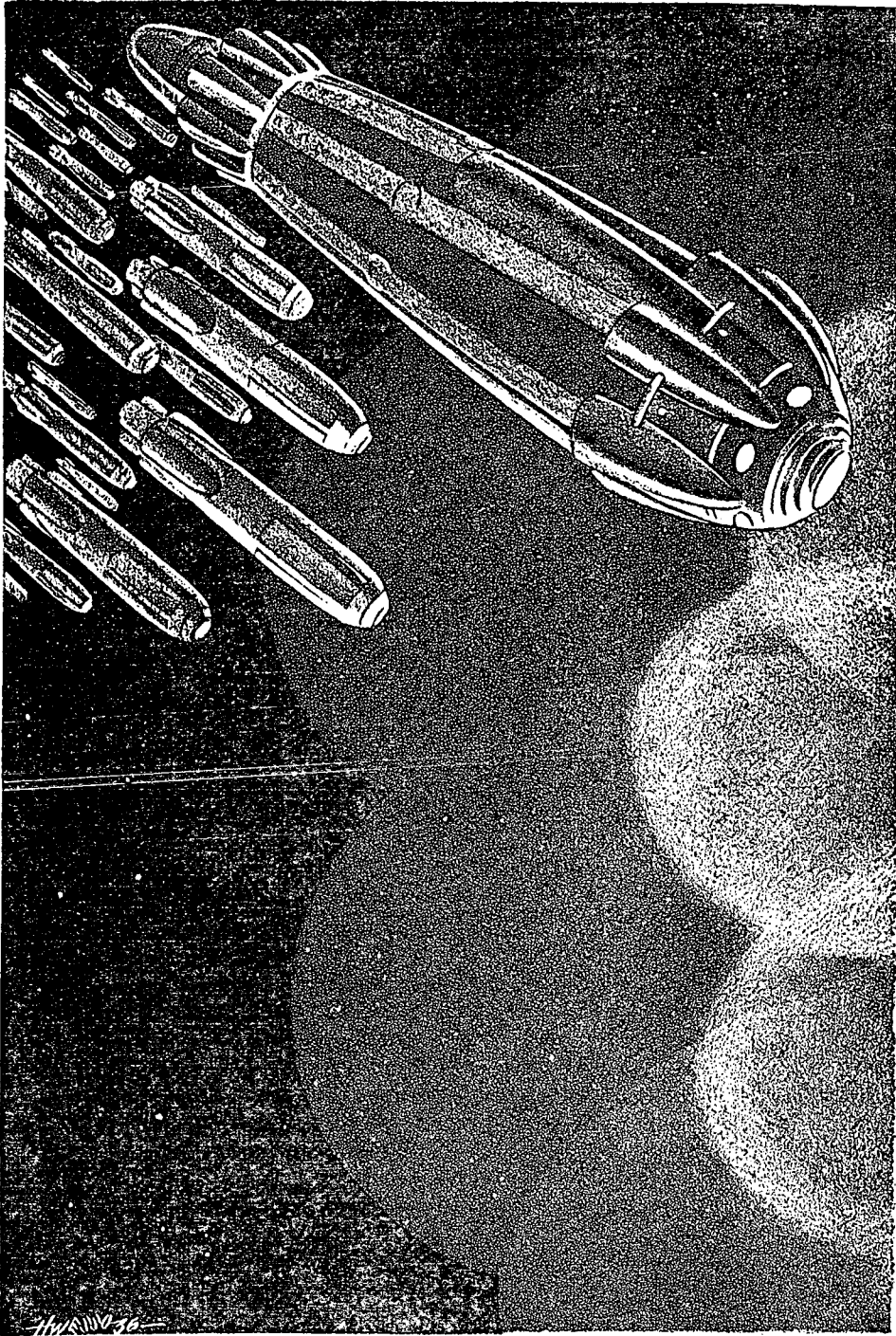
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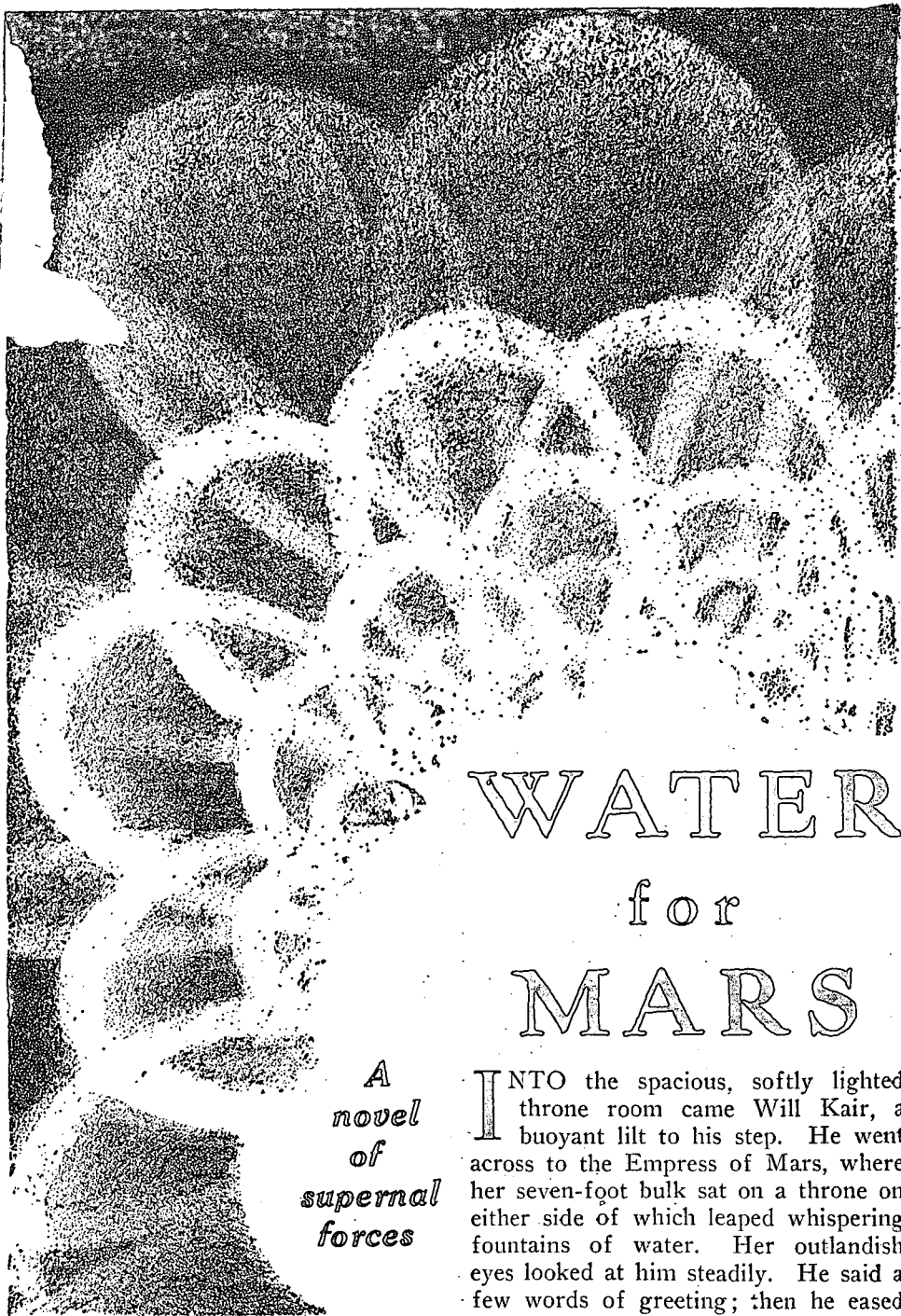
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other
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endorse
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*For a while as time goes, for æons as the mind of man and Martian saw
it then, that white flower of luminescence suspended in space.*



WATER for MARS

*A
novel
of
supernal
forces*

by Ross Rocklynne

INTO the spacious, softly lighted throne room came Will Kair, a buoyant lilt to his step. He went across to the Empress of Mars, where her seven-foot bulk sat on a throne on either side of which leaped whispering fountains of water. Her outlandish eyes looked at him steadily. He said a few words of greeting; then he eased his stocky length of efficient muscle and bone into a chair, and stretched astonishingly long legs out before him.

He said exultantly, "Well, I've found it."

Her double-lidded eyes were coal-black; they took fire. She leaned forward. Her monstrous, ebony arms grasped the sides of her ornate throne. "Go on," she rumbled.

Kair said happily: "Lord! Three years, now, looking for water, and I've got it. Three years! Tried the oxygen-hydrogen combination; but where could I get them in sufficient quantities? Tried baking it out of gypsum—same trouble. And Venus? The water venders have a strangle hold on that planet; anyway, ten thousand such water ships, even if you could meet the fabulous prices demanded, wouldn't do any good.

"Lately, I began to wonder about the asteroids.

"Empress, you've probably never heard of Bode, but he was a fellow with a dream. He thought he had found a progressive numerical ratio that would give the relative distances of the planets from the Sun. He took the numbers 0, 3, 6, 12, 24, 48, doubling each time, you see, added 4 to each, and divided by 10. He stuck these numbers out in space, their own largeness determining their positions, taking the distance of the Earth from the Sun as unity. And it worked out almost exactly. Mercury hit 0; Venus, .7; Earth, 1; Mars, 1.6; Jupiter, 5.2. But then Neptune came along and was quite a bit off, but not enough to disprove the theory. But Pluto confounded the figures altogether.

"That's the way they discovered the asteroid belt, though. You notice that 2.8 was missing. They looked for another planet there. They found the remains of one, which was good enough.

"Seeing no reason why that planet might not have possessed water, I went out there and looked around. I found about 50,000,000 cubic miles of it conveniently concentrated on one of the largest chunks."

Her eyes were raised to a window, through which she could see the monotonous sweep of the red deserts. She smiled gloriously. Then the smile disappeared. She said slowly, "Instar is here."

The water hunter sneered at the name, but said, "Show him in."

MINUTES PASSED. The somber curtains at the far end of the room were thrust aside. A Martian, tall as the empress, black as night, thin-faced as a hatchet, swung boldly forward. He stood very straight; his eyes glittered; his lips drew back in a mechanical smile. He bowed to the empress and then to Will.

"You may meet Will Kair," rumbled the empress.

"I am overprivileged," said Instar according to formula.

"You may take the insolence from your eye. You know Will Kair?"

"The water hunter."

"And you are the water hater, so-called," exclaimed Kair, jumping up. "We work at odds, and I have never heard of a stranger thing! How is it you don't want water on Mars?"

"Because I hate Earth, on which breeds corruption; because Mars would become as Earth. Listen to me, Will Kair. Why are there wars on Earth, disease, economic ill adjustments, social ills, and general discord everywhere? Because there are so many people they get in each other's way trying to manage themselves!

"There are only a million Martians. What would happen were they to swell to a billion? Do you think we would continue as we now are, welded into a sort of peaceful community, all working for the common good?

"There is a law that population increases with the increase in food supplies. Will not water act in that respect? We will become so numerous that we will get in each other's way.

We will fight; we will hate; we will turn into beasts such as Earth spawns.

"We are a great race, great in culture, in ideals; but water would bring corruption."

"But lack of water means racial death!"

"Death in glory, never life in degradation."

His hawk face became a mask, but his inner eyelids closed. He stared through the transparent membranes at Kair, who felt chilled. Instar said in a sepulchral tone, "You have found water; I ask you not to bring it to Mars." It was not a plea; it was a threat.

The empress said: "You may go."

Instar continued staring at Will for a moment; then he pivoted, and left.

"I wish I were not a Martian," the empress said angrily. "Then I would have the barbarous ability to order his death."

"Watch out for him," she whispered. "He is your greatest danger; he and his water-hating cult. There are many Martians who think as he does. But until Instar came there was no Martian strong enough to band them together. We are weak-willed; we are not very progressive. Perhaps our knowledge of gradual race extinction has done that to us. But Instar is an exception."

"Will," she whispered, "once I was on your planet. I looked at your great green meadows. I stood in the rain. I did not think of anything save what water could do for Mars. Death by thirst is not my conception of glory."

"I hate eternal red sand! And it has not rained on Mars in a thousand thousand years."

"I shall make it rain if I can," replied Will plainly.

II.

HUMMING a tune through pleasantly curved lips, Will Kair walked the promenade deck of the *SL President Androe*, a space liner that was magnifi-

cent, with its shiny metal gear, its smartly tailored officers, and its luxurious accommodations. At this moment the deck was empty, everybody except Kair, apparently, having gone to the ballroom, where a twenty-third-century orchestra blared out its blatant strains.

He had stayed on Mars a number of weeks, resting, then had booked passage on the first Earth-routed liner, intending to put his affairs in order for the next two years; something might happen to him, he reflected, though he would not admit that Instar caused him any unease.

"Damned silly," summed up his opinion of the water hater.

The liner was a week out from Marsport. Walking slowly, Kair decided suddenly to retire. He went down a corridor, which suddenly became dark at a certain section, due to the failure of a light bulb. And, because his thoughts were occupying him more fully than his surroundings, he collided with another person. Instantly, his arms went out around the co-collider, thus restoring balance.

But his arms did not untwine, and he uttered no apology. He started to smile, for the person he had in his arms was a girl, and from the softness of her body, and the faint suggestion of an exotic scent, he guessed her to be young and beautiful. He didn't remember holding a girl in his arms for some time, and now it seemed rather pleasant. She did not break away, so he bent down and kissed her.

She did not slap him. This indicated her gentle breeding. She merely shoved against him with all her strength, and Kair could just see big, furious eyes, and a curved, up-tilted nose.

She looked him full in the face, then went away with an outraged clicking of heels. Suddenly she looked back and snapped, "Will Kair?"

"The water hunter. Does that mean anything?"

"Not a thing!" she retorted, and walked coolly away.

They met again the following evening, in the after part of the ship, which was glass inclosed, showing Mars dropping behind, redly breaking the monotony of the white star curtain.

"Good evening, Bella Devlin," said Kair, coming up to where she stood leaning on the railing.

She turned, startled, and then pursed her lips. "The stewards are very obliging in pointing out people, aren't they?" she said acidly.

"For a consideration, yes." He saw that she had an exquisite figure, slim and exotically graceful, and the sea-green gown accentuated it, at the same time matching to perfection the light green of her eyes.

She regarded him detachedly. She began to smile a little. "So you're the fellow we hear about," she murmured, her voice soft, a little husky. "Don't you think Mars ought to get her own water? Or are you doing it for a consideration?"

"I've got money," Will told her, an edge in his voice. "I'm doing it—because I want to."

"Poor fool of a water hunter," she said casually, "goes into it blind. Goes ahead, finds water, and thinks all he has to do is go ahead and fill the oceans."

"What's that?" inquired Kair, puzzled.

"He doesn't know all the trouble he's going to have," she went on.

"Trouble? For filling Mars' oceans? That's silly."

"Silly, is it?" She turned around, slowly. "There's more to it than you suspect. Do you know what you're going to do to the medical science of Earth? You'll set it back a thousand years!"

He only stared at her.

"When you get back to Earth, a certain official, representative of the United

States of America, is going to tell you to stop it!

"Take your hands off my shoulders, and quit shaking me! Now, listen, Will Kair, water hunter! Science has been making a fight against disease ever since Pasteur told them what a disease was. Finally they got so they could use radium.

"I suppose it isn't your fault you don't know, since the Radium Co., Ltd., keeps it secret to maintain the price, but—all our radium comes from is. That isn't all. The principal deposits are located on the dry sea beds. Now does that spell trouble?"

Will Kair, water hunter, got it. He started to shiver. He leaned back against the railing. He got his pipe going. The clouds of smoke looked green in the starlight.

"It's wonderful," the girl said softly, "to want to save a dying race, but you're not going to deprive Earth of the radium it needs, are you? You belong to Earth. Let Mars wing her own orbit.

"Think it over, Will Kair, and, if you want to, I should like to see you to-morrow as the chronometer goes."

He put his pipe in his pocket. "Wait a minute. I don't want to think it over now. My thoughts are like daggers!

"I want to dance. I haven't danced for a long time."

"Could you?" She made her voice light.

His answer was to take her arm. He moved quickly toward the ballroom. Will Kair, water hunter, decided that he could certainly stand some of that blatant, twenty-third-century music pounding in his ears!

KAIR went back to Earth, while Bella Devlin, along with several other passengers, went in a subship to Venus. She had an uncle there, she said.

He couldn't forget her. He had spent some decently happy weeks aboard

the liner with her, and she had helped him fill the emptiness in his heart. But there was some mystery about her which he had been in too much of a daze to solve. How had she known about the radium? When he saw her, he'd ask.

No sooner was he situated in a hotel than he got a radiogram from President Wilding, stating that he was sending a Mr. Lewis, who had full authority to act in a certain matter pertaining to the activities of Mr. Kair. Will found himself grinning. Apparently he had become something of a personage.

Promptly at the time set, a tall, thin man, with aristocratic features, arrived. Kair showed him to a seat. For a while they talked on inane topics; the weather, the African outbreak, the difficulty explorers were having in finding out exactly what the red spot on Jupiter was all about. Kair avoided the main topic. Let Lewis bring it up! Kair supposed that an occasional monosyllabic yes or no would do well enough on his side, then.

Lewis finally stirred, stood up. He said, "There's no use in fumbling around with diplomacy and euphemistic words, is there?" He cleared his throat. "I am informed that you have found a source of water for Mars?"

Kair gave him the obvious monosyllable.

"This will fill the dry sea beds?"

"I don't see how it could be otherwise," said Kair gravely, "the law of gravitation being what it is."

"Most regrettable, most regrettable! That you should discover water, I mean, when it cannot be allowed to benefit the planet. How, how, Mr. Kair, did you overlook the radium mines?" he exclaimed.

"Well, when you have a thing burning in your brain like I have, it kind of dims out other things."

Lewis shrugged. "I have a paper here, an order which, in effect, tells you

to drop all your plans at once. No use fumbling around, is there?"

"No, no use fumbling, since I know all about it anyway," murmured Kair. He took the paper, which was stamped with the red of an official seal. He glanced at it, then laid it on a polished end table. In spite of himself, his thoughts became bitter.

He said to Lewis: "I can take most things very complacently; usually, when a setback comes along, I simply laugh. Now I don't feel like laughing, because this is a blow I'll never forget. You've no idea how I wanted to— Think of those damned other deserts, and those cloudless skies!

"Well, I can see the hand of Radium Co., Ltd. in it. You didn't know about those pitchblende deposits either, I imagine. Denton was keeping it secret for financial reasons, but he had to tell all when Will Kair found water! The medical society's got a stick in the fire, too, but I don't blame 'em. They need radium.

"So I'll have to give in, but not to the hilt. I mean, I've found water, and it's not going to waste. Will you keep what I tell you quiet for a while?"

THE MAN promised he would say nothing.

"Out there in the asteroid belt," Will said unhurriedly, "you'll find a very shiny asteroid, so shiny it reflects back three quarters of the light it receives. Albedo, in other words, three quarters.

"They used to wonder about it— Vesta—why it was so bright, but they never investigated—too busy finding out about the major planets. But I found out why. It's got an ice content of four fifths, and, believe me, that is a great deal of water! Just about enough to fill the sea beds and bring a beautiful network of rivers down from the uplands.

"You've heard of Instar?"

"Humph. Kind of a myth, isn't he?

Nobody believes there are Martians who don't want water."

"Well, believe it now," Kair told him grimly. "They don't want water on Mars, and that's a fact. Race corruption, they say. Death in glory, they say, poor fools.

"But when Instar finds out about Vesta, he'll blow it up! So it has to be guarded, and guarded heavily. There must be garrisons and plenty of men, to stay there until the mines are worked out. That's my only provision. But you might just as well insert it in the United States Constitution, the agreement will have to be so strong."

The tall man's eyes became patronizingly expressionless; his lips drew back in a thin smile.

"Radium," said he, politely, "has to be handled very tenderly. Like a wildcat, treat it carelessly and it'll bite." He added casually, "It'll take about a century to extract it all."

"Well, that's all right, let it take a century. I don't care, and it won't matter a whole lot to Mars." He watched the other man closely, almost reading his thoughts in his eyes. He became inwardly furious; but in the back of his mind triumph was rising. If only he'd refuse! Then he'd have a damned good excuse to ignore mankind and its need of radium! But Kair didn't even realize his possession of these traitorous thoughts; his conscious thoughts were mostly of anger that the man would even dare to refuse!

"Aren't you taking it all too seriously?" Lewis was saying. "Martians are alien to us. Why, you act as if you have been appointed as their protector!"

"I don't like to argue points like that," answered Will impatiently. "Out with your final answer, and let that be the end of it."

"Can't be done!" snapped the other man, jumping to his feet, nettled. "Why, Kair, that's the most ridiculous, absurd piece of nonsense I ever heard!

You're making a damned fool of yourself, going to such a bother about a race of people whom you don't owe a thing!"

Kair flushed angrily. "You're speaking with full authority?" he asked coldly.

"You saw my credentials, didn't you?"

"That's all I want to know. Now I can go ahead. Tell your president that Will Kair says it's no go! I haven't spent three years of my life for nothing, and Mars is going to have some of those rivers and green meadows I'd like to see on her. I herewith transfer all my loyalty to Mars. Why should they die any more than people on Earth who need radium?"

"So we'll just terminate this interview."

"You'll be working outside the law," came the sharp reply.

"Whose law?" Will asked in huge enjoyment. "Earth's? Mars'? Or my own? How will *your* law reach out to Vesta?"

"It'll reach out there," said Lewis savagely, pointing a finger. "Kair, right now you're labeled a traitor, and you'll never get away with it!" He laughed harshly. "And if you think those senile Martians are going to help you effectively, you're a fool!"

"Go ahead and put your rockets up, and get started. We'll let you enjoy yourself a little while. After that, you'll see that the arm of the American government is perfectly elastic, even over billions of miles. Good night!"

He left without another word. Kair went to sleep very much satisfied with the events of the day.

THE NEXT DAY Will went back to Mars again. He was alarmed. Not until he had put his own fears of Instar into words had he realized that he had those fears. Now, he reasoned, the nature of shiny Vesta would become

known. There would be a presidential report. It would doubtless pass through many hands, and who could stop a leak? The more the thought ran around in his head, the more alarmed he became.

In a fever of anxiety, he left the ship at Marsport, rocketed in a single passenger ship across the dull deserts, and followed a main canal to the capitol.

Will Kair had no better friend than the empress, nor did she have a better one than he. But now, as they sat over a tart, cooling drink, he was dismayed by a certain suspicion.

She saw the way he was looking at her, and, in that instinctive gesture a Martian employs to hide his thoughts, her inner eyelids dropped.

Will lost his taste for the drink.

She rose, hastily, clumsily, her thick lips set in contrition. She laid a heavy hand on his arm.

"I knew of the radium mines," she said slowly. "But I couldn't—couldn't force myself to let you know. I even gave orders—Earth is not my planet," she finished simply.

"All right." Will waved a hand that dismissed the incident. "Earth, I suppose, isn't my planet any more, either."

She whispered sadly, "I know."

Will said thoughtfully, "I was wondering why you couldn't simply annex those mines, empress. But I suppose it wouldn't do any good, anyway. Earth would fight against covering them, because there'd be no means of getting them back after the water menace was destroyed."

"And Mars," the empress inserted, "is such a poor planet! We are paid a great deal for those deposits." She exclaimed scornfully, "Enough to pay the water venders of Venus for what little water they choose to bring us, now and then!"

Will laughed. "In a year, or two years, perhaps, you'll have water! You won't have to bother with the water venders! But this is the present," he

added soberly, "and I'm afraid Vesta is in danger."

"What do you wish?" she asked quietly.

Will told her, and together they made plans with regard to Vesta's protection—a horde of patrol ships, and men to man them.

"And, if possible," Will added, "some sort of a detector system to put around the asteroid. Your race has matured beyond war, empress, I know, but in your younger days, you knew something of these things, and retain the secrets."

She nodded. "Vesta," said she, "shall be protected, as well as time will allow it."

Suddenly, she looked at him, and a tear came down her harshly black and fat cheek. Will rose, walking in embarrassment toward the window, where he could see the fast-moving lower moon, Phobos.

"None of that," he muttered. "I'm doing it, because—because I'm sick and tired of hearing and reading about the dying red planet! That's all there is to it!"

III.

WILL came to Vesta with his men and ships and engineers, and, looking at that massive planetoid—massive, that is, as planetoids go—he felt small at facing his Gargantuan task, though he knew that men had moved planetoids before. There were plans to go by; all he really had to do was follow them, enlarge them to scale. Vesta was 241 miles in diameter.

Of course, the body was airless and heatless; the plans naturally called for large domes to maintain atmosphere and heat. There would be five of them, the smallest one being the center of a square formed by the other four. This central dome would control every machine on Vesta, including the rocket jets calculated to move Vesta from her age-old path.

Power? Solar engines, which in 2344 A. D., had reached a high degree of perfection. Materials? Nature had provided metals æons ago, when a vast explosion had shaken the universe and shattered a planet into about two thousand small pieces. And what couldn't be got from the asteroid belt was shipped from Mars.

So Will got his domes up, and began to stick the rocket jets up through the apexes of four of them. There were, quite naturally, some setbacks at this stage. For instance, Vesta was composed mainly of ice, with a sprinkling of nickel, iron and a few other elements. Now, in the domes, that ice, attacked by heat, began to melt. Foundations would crumble. Water would flood into the power houses. Havoc, holocaust! Sometimes gaping holes would grow under the domes, letting the air out into space.

Will Kair became a madman, cursing the laws of a universe that permitted ice to melt. His nerves tightened. His eyes got a glazed look in them. It was not enough to have Instar sneering at him in the back of his mind; not enough to know that Earth was waiting for him to finish his work, so that it might be destroyed; not enough to realize that he had a torturing desire to see Bella Devlin. The damned ice, however, insisted on melting, and Will finally had to set down a metal foundation for each dome, a disk of metal a mere 22,500 feet square!

Then he went ahead, brought in vast quantities of supplies from Mars and from the asteroidal river, and worked his Martians in double shifts toward a swift finish of the work.

All this took some time—a year and some months. Will finally sat back and let the work finish under its own impetus.

He felt very tired, and when news was brought to him that a Bella Devlin had cut the detector screen surrounding

the planetoid, his heart beat with new life. He ordered her brought to him in his quarters.

When she came swinging toward him, smiling radiantly, he told himself he had never truly seen her. She must have been traversing the void alone for some days, but the strain had not sent a spider's web of wrinkles up around her light-green eyes, nor had the synthetic air robbed her cheeks of a fraction of their rose-bloom hue.

He took her in his arms and kissed her, and then she sat down opposite him. He felt a little subdued; her response had not been as warm as it could have been. And now that he studied her, he saw something enigmatic in her eyes. As if she were a little weary, a little desperate about something.

"You look so tired," she said, and it was really sympathy in her voice.

"Tired? Don't be so mild. I'm a wreck!" He grinned, and got up and sat closer to her. "Or was, until you came," he added tenderly. "Bella——"

SHE shoved him away, and looked at him in a mock school-teacher's attitude. "Will," she said sternly, "tell me something. When I told you about the radium deposits on Mars, I thought that you were——" She started looking at her fingers.

Will said slowly, "That I was going to quit the whole business?" He started to smile. "Scolding me?"

"Yes," she answered defiantly.

"What for?"

"For turning traitor to the society that made possible your existence."

"I had a good enough reason," he retorted stiffly.

"Good enough?" she inquired caustically. He was surprised at the bitterness of her tone.

"Wait a minute!" he snapped. "Why are you here?"

"To try to talk you out of it," she replied coolly. "What do you call a

good reason, Will? Do you think anything is good enough reason to sacrifice the lives of an uncounted number of people on Earth on the altar of your meddlesome desire to save a million thirsty Martians?"

He said steadily, "Don't talk nonsense. I'm saving a race, not a million people."

"People?" she asked, raising her eyebrows.

"People," he repeated. "They are human. Look at any one of them. There's not a chance in millions that a race as nearly identical to ours as that of the Martians could evolve independent of us. That's the truth. Interplanetary travel certainly took place a long time ago. They are our flesh and blood, only environment has changed them a little. Do you see that?"

"Yes," she retorted, crossly. Suddenly her eyes became pleading. "Haven't racial ties a millenium old grown rotten and broken by this time, Will? Haven't they? Besides, if you take water to Mars, you'll never feel right when it's ended."

"I know," he admitted.

She stared at him with a wholly inexplicable fire.

"You'll give it up; I know you will!"

"No, I won't," he contradicted her firmly. "I've started now, and I won't stop. Anyway, it's in my blood; I've got to go ahead! And—I've given the empress my solemn promise."

She set her lips angrily, started to say something. Then she rose. She walked across the room to a picture of New York tacked on the wall. Then she came back, and she was smiling. She looked a little excited and anticipatory. Whether this was feigned or not, Will could not tell.

"Will," she cried, "if you won't do that for me, you'll do something else? You'll let me stay here?"

He came to his feet in astonishment. "Are you serious?"

"Serious as I never was before," she replied.

"Why, then," he drew a big breath, "Vesta is yours!"

"Oh, is it?" She smiled steadily, and added, "You'll have to show me around."

BY RAIL CAR that connected the frozen, airless surface of Vesta with the other domes, he conducted her on a tour, showing and explaining each major detail of the work.

Martians worked busily. There was an army of them, their sweating bodies seeming dark red in the light of molten metal. Together they watched a section of the rocket jet—a tapering, rounded, heavily foundationed tube extending up a hundred feet to pierce the dome—being welded onto the skeleton work, Kair being quietly proud of it all.

He showed her the five huge tanks which supplied five different ingredients of rocket fuel to five thick conduits which terminated in the base of the rocket jet. Those ingredients, encountering each other in the combustion chamber, would mix in a furious chemical action that would give birth to large volumes of explosively expanding gases. With all four jets firing, Will Kair told her he'd be able to move Vesta in any direction he wanted to.

They watched the workers for a while. Bella said, "I never saw such furious activity."

"That's because they know what Vesta means to Mars," he told her, and added, "They'd die for Mars—and they'd die for me. I am a god to them."

"Let's go," she said in a muffled tone. "This dome is like the rest, isn't it? Tanks, and warehouses, and living quarters, and switchboards, and generators? Well, then, I'd like to see the central one."

The central dome was smaller than the others, but was the heart of the whole affair. Here were master

switches and controls which could, upon necessity, operate any mechanism on the planetoid save the patrol ships. Bella was inordinately interested in the mighty machines of a power room which clothed Vesta in a tenuous stable radiation for a million miles around.

"I wouldn't last long if it wasn't for that detector screen," he told her soberly. "If Instar should come along with a few ships, now, he wouldn't last long. In a few minutes, before he could get near the asteroid, the patrol ships would know of his arrival by the fluorescence of their detector disks; they'd blast him and his ships out of existence. The possibility of surprise is eliminated, and that's the greatest weapon there is. But if a water hater should get by the empress, it would be too bad; a bomb would suffice to ruin Will Kair—and his dreams for Mars."

She changed the subject a little. "Do you know where Instar is?"

"No. The empress kept track of him, from the moment she knew I'd found water. I was still on Mars when he disappeared, nobody knows where. He hasn't any funds that would enable him to proceed against me, but maybe he went to Venus. You know, the water venders. They'd help him, just to keep water off Mars. You see how complicated it is. Water haters, water venders, and radium on the sea bottoms. But I prefer not to worry."

"No," she said mournfully. "You mustn't worry about anything."

"I'm sorry," he said gently.

She shrugged slim shoulders to show that she did not wish to discuss the subject at this time. But Will knew what she was thinking, or thought he did, and it vexed him. He began to feel regret that she had come at all for, in spite of himself, his conscience was beginning to stick pins in him—and she had been the cause.

In succeeding weeks, as Vesta winged her way in her orbit to a wholly satis-

factory nearness to Mars, and as the finishing touches were put on the mechanisms that were to tear Vesta from that orbit, this feeling grew to greater proportions. An impalpable barrier seemed to rise between them, a restraint born from the diametrically opposite views each held. For days at a time, Will did not see her, and when he did, it was only to exchange a too-polite comment on their respective healths.

So Will knew that she was against him, bitterly; but he didn't care any more. Everything else was against him, too. Earth was taking her leisure before stepping in; Instar certainly had some kind of unpredictable preparations made; and his own conscience pricked him. But he had only to look at his now perfectly functioning work to become aware that the old, irresistible urge to bring back to Mars the silvery rivers and heaving oceans she had known in ages long past had grown into a passion which inflamed his soul.

Water for Mars! The cells of his brain yelled the old battle cry at the whole resisting universe.

Now there were a few switches to throw, a few gauges to watch, some calculations to make, and that was all there was to it. Then let Earth come with her warships; let Instar come with his water haters; let the cosmos itself do its worst. He, Will Kair, water hunter, felt utterly isolated from all compassion and hope, but he no longer cared.

IV.

VESTA had had the ill luck to have man's brain wonder why she had such a high albedo. So upon her back had grown a system of machines. Thus far, drowsily content to wing her way peacefully and unobtrusively in a great elliptical orbit about the Sun, whose light she radiated back as if she had no use for it at all, she was going to feel

a pressure contrary to all the laws of free will and inertia as she had known them.

She would shudder a little, then cease rotation. She would falter in her orbit, making irredeemable steps in altogether the wrong direction. She would curve. Presently, vivid and dangerous, the red planet would loom up in her path.

Vesta, born millions of years before, was going to her death.

Will Kair was ready. He had checked and rechecked. Now he sat before a television cabinet, waiting for the propitious moment.

Bella came in. She looked wanly beautiful, Will thought, and very sad. She sat down opposite, started to look at him.

"You're going on with it?"

"Yes."

"Why?"

"I've grown a little callous, Bella. All my life I've hated the idea of those Martians dying off, so I went ahead and looked for a way to save them. Now I am not going to quit just because Earth will be comparatively discomforted. Do you see that?"

"I wanted to tell you why I seem so interested, Will." She hesitated. "I am quite well known on Earth as Dr. Bella Devlin."

"Oh." He stared at her, startled. He tapped out a staccato sound on a metal plate, thinking. He asked, "How did you know about the radium deposits, if no others did?"

She said steadily, "I knew Denton of the Radium Co., Ltd. quite well."

He got to his feet and put his arms around her. Then he kissed her. He sighed disconsolately. "It's no use," he muttered. "No matter what I do, something goes wrong. There are so many things to make a man's life go wrong, and they creep up on him from behind. Now I'm going to lose you—even though I love you."

She nodded sadly, resignedly. She

pushed him away, and left him, to go ahead without a further dissenting word. Will licked dry lips.

WILL quartered a vision plate. In each segment appeared the black, hawk-nosed visage of a dome commander. Will held a watch in his hand, looking at it. He nodded. Each dome commander depressed finger-sized switches, meanwhile watching gauges which registered to fractional amounts the fuel flowing into the individual combustion chambers.

Minutes passed. A slight shuddering rippled underfoot. A thudding of soundless vibrations set Will to shivering.

He cut in another plate. The image clouded, became clear, and he saw the perspectiveless vault of the firmament, the lower half of the picture broken by a barren vista of white ice fields, and ice crags which toothed up into the sky. In the upper corners of the plate, tiny, intermittent tongues of flame licked feebly at the whiteness of the celestial night.

Will breathed a sigh of relief. Then he put himself to his first task—that of depriving Vesta of her axial rotation.

All that day he sat in the control room, taking the reports of telescope observers. All that day he felt the tremors rippling underfoot, as if he were aboard a ship, plowing through a Terrestrial sea. Nor did the likeness stop there: Will was dictating facts to the asteroid, namely, that she must now assume stem and stern!

Vesta assumed stem and stern. She became indeed nothing more than a monstrous ship of the void. Martian mathematicians got to work, asked integrating machines certain questions, at this point. A trajectory and rate of acceleration for Vesta had to be determined, and this was difficult. Will's whole plan lay in disrupting Vesta at a point a few miles above the atmos-

pheric fringe; atmospheric friction would adequately do the rest. But Mars' velocity was not constant, since, in accordance with Kepler's laws, it moved faster as it came to perihelion. This merry-go-round question evolved: if Mars reached a point in its orbit at which Vesta would intersect it going at a certain velocity, what would that velocity be, and her direction, if the point of intersection were known?

There were ways to answer this question, by an ascent into the realms of higher mathematics, but it was nevertheless difficult, for while the calculations were under way, Vesta was moving at a good many miles per second, as was Mars. Fortunately, an error of a little more than 2 per cent was allowable, and a conclusion was reached that necessitated a constant speed of 15 miles per second three million miles from the point of intersection, and a trajectory whose extension would pierce two first-magnitude stars.

Intermittently, then, one or the other of the jets would belch forth its tongue of incandescent gases. Even as she moved, Vesta twisted, until stem and stern formed a line parallel to her trajectory. Now, by applying reaction carefully, Vesta would execute a gradual curve that would straighten out to her final path.

GINGERLY, Will increased the power. Now the star field began to shift. Slowly, Vesta was brought around to position. This went smoothly. But now the delicate matter of velocity increase had to commence. It was dangerous, and it brought disaster.

Vesta was by no means firm. Terrific forces—the back kick of the rocket jets—had been pounding at her, and now one whole rocket jet sank into the ice foundation; the fuel conduits burst; the dome cracked through the center, and havoc reigned.

A small earthquake shook the central

dome. The stars began moving, the lack of equilibrium of forces having reinstated rotation. Kair viciously ordered the jet of Dome A—directly diagonal to that which catastrophe had seized—to be cut. It was cut, but Jet A continued to belch forth its gases for a while, for its combustion chamber was stocked with raging chemicals.

Kair waited, tensely. The tremors had ceased. Meanwhile he watched Dome C. It was in havoc. The air had swiftly seeped up through the rent in the dome, had encountered the cold of space, had fallen onto the dome as air snow. Great plumes of noxious liquids had spurted from the torn conduits, had spattered up against the dangerously leaning jet, and had frozen into horizontal icicles. Men had donned space suits, and if they were not helplessly standing in one spot, they were as helplessly running to all spots.

Jet A ceased firing, and Vesta stopped acceleration around her new, joyously assumed axis. That was all Kair wanted. He had considered righting Vesta, but, with only two diagonal jets to work with, it might be just about as easy to balance himself indefinitely on the hind legs of a chair. He let it go, and started repairs on Dome C. The dome had to be mended, the jet uprighted, and a new combustion chamber had to be shipped from Mars. Atmosphere had to be provided, and heating units got in working order again. Numerous mechanisms had cracked under the sudden contraction the spacial cold had incurred.

When all this was done, when Kair again urged Vesta on, he felt tired, and feverish. He wished unbearably for Bella Devlin to come; but she made no appearance.

V.

"EMPRESS," said Will Kair about a month later, as her tall, black, thick-chested body formed tenuously on the

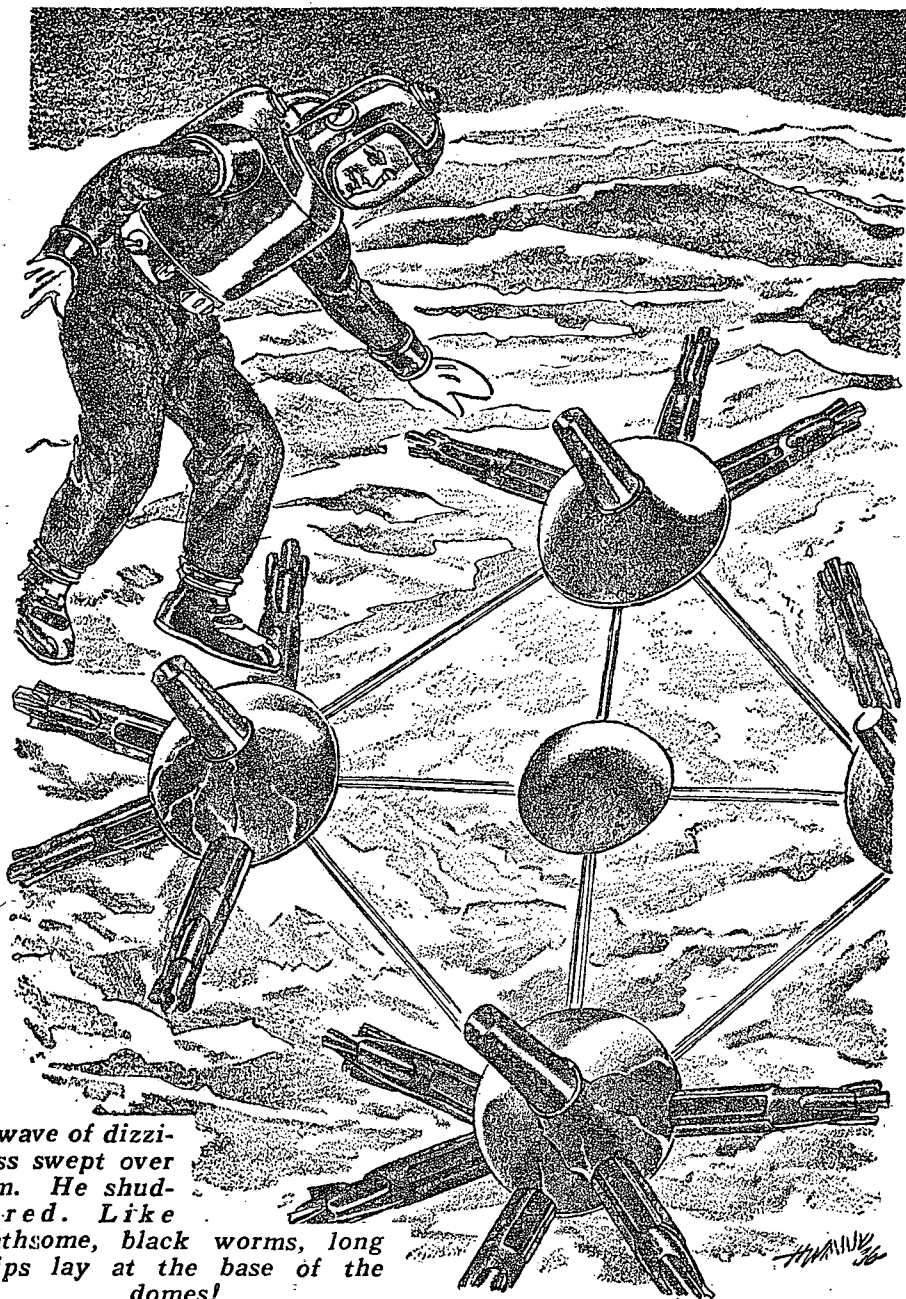
plate, and wavered uncertainly like the reflection from a pond of water, "Vesta is seven million miles from Mars. Do you think Earth is going to stand back and let me get away with it?"

"No," she said serenely.

"Are you prepared to protect me? I'm counting solely on you, remember."

"We are prepared." She nodded.

Kair lifted his brows. "You may



A wave of dizziness swept over him. He shuddered. Like loathsome, black worms, long ships lay at the base of the domes!

have to face the eventuality of interplanetary war."

She laughed sneeringly. "Let there be interplanetary war!" she rumbled. "Do you know that Earth thinks we are weaklings, unfit to live?" she cried in a tone of outrage. "Now perhaps we shall have an opportunity to show her different! Hundreds of thousands of years ago, we were barbarians, and we were more progressive in the matter of war than Earth is. Earth knows nothing! Three centuries ago she had explosives that exploded with terrible violence; to-day she has nothing but explosives that merely explode with a greater degree of violence!" She grimaced reassuringly. "You have nothing to fear. Mars is ready!"

As coincidence would have it, Will had made sure of this none too soon. Hardly three days later, a patrol captain, blinking in fright, informed him that an armada of huge ships had drawn up a scant two million miles from the ice asteroid.

Will automatically called the empress again, and across seven million miles her image struggled to establish itself in the plate. Not yet had twenty-third-century science been able to fling radio waves across a distance of more than seven or eight million miles, and this with difficulty. She listened to Will, nodded slowly. She said, "I will remain in my palace, in the event that I am needed."

Will sat back and waited. A rat of fear began to gnaw at his heart. If the empress was underestimating Earth—

A gong rang, insistently. Will calmly found the wave length, switched in the contact. Into the plate came the image of a proudly tall and erect man, whose chest blazed with the gold insignia of his position. His eyes were cold, and balefully stern.

He boomed stridently, "Will Kair!"

Kair leaned back, and said in surprise, "Hello!"

"I am Admiral Regarde!" the man lashed out. "I have orders to seize Vesta, demolish the mechanisms you have built on her surface, and take you into arrest!"

"The charges," asked Kair lazily.

"For treason to your country and your planet!" he roared savagely. The steel of his voice and the flint of his eyes almost produced sparks. "Are you going to submit, Kair? Or is it force we'll have to use?"

"I don't know," answered Kair. "I don't know a thing about it. Contact the empress. She'll know."

REGARDE'S EYES flashed. With hardly a movement, he signaled an officer, who busied himself over a television cabinet. In the meantime, Will halved his own vision screen, waiting for the royal image to appear. On the flagship, the plate swirled cloudily, became abruptly clear, but Will preferred to watch on his own plate.

"I am the Empress of Mars," said the empress, grimacing toothily at the admiral.

Regarde eyed her with hardly an attempt to conceal his distrust, but nevertheless injected a diplomatic suavity into his voice.

He said: "I have orders to arrest Will Kair, and to seize Vesta!" He added impatiently: "Will Kair has been charged with treason against his planet and country, your majesty!"

"Ah."

"Can you change matters?" Regarde asked testily.

All in all, the empress was not a very beautiful object. Her stiff, small ears twitched. Her lips drew back over large, yellowish teeth. She closed her eyes, and withdrew inner and outer lids in slow succession.

She rumbled ominously: "Vesta belongs to Mars, admiral. Did you receive my permission to land?"

"Your permission? Does it belong to you?"

"The colonization law," she answered lazily, "is universally applicable. I have had five hundred members of my race living on Vesta for a long time."

"Means nothing!" Regarde exclaimed, nettled. "I've got orders to take Vesta! And I'm going to take it. If you want to resist Earth——"

"Are you declaring war?" she demanded angrily.

"Empress!" muttered Kair, aghast. This man did not have the authority to declare war; to get the necessary official for that, a ship would have to be dispatched back to Earth; and by the time it returned it would be too late. And by the light that had leaped in Regarde's eye, Will knew he had not overlooked this fact.

Regarde started to speak, stopped.

The royal features showed impatience. She struck a table near her such a blow that it shook. "Declare war! Declare war!" she exclaimed vehemently. "Isn't that what you want to say? You upstarts of Earth! How I should like to show you that we are not as senile as we seem!"

Regarde frowned, stroking his chin, started to speak, subsided.

"Then I declare war!" the Empress of Mars cried magnificently, striking her chest resoundingly.

The admiral started to smile. He bowed and said lightly, "Very well, your majesty." He waved his hand. He disappeared from the plate.

Will turned cold. He faced the empress, who still was etched in the upper half of his plate, but he could not bring himself to utter the words of condemnation. In some ways, the empress was like a child.

"Drive Vesta toward Mars," she whispered gently. "Earth shall not land." She was gone. With lagging enthusiasm, Will Kair drove Vesta toward Mars.

ALL HIS FEARS were growing to a head: Earth was here; and he was not fool enough to suppose that Instar had not made some sort of plans in the event of Earth's failure.

Up from the surface of Mars rose a black, skinny vessel. It ascended into, and merged with, unfathomable spacial sky. It was an ugly ship, being blunt at the stern, and tapering at the stem; it seemed poisonous, and almost radiated forth an unthinkable capacity for destruction.

Onward it glided, working up to a tremendous velocity. It shot past the two moons; it cleared a river of meteors, and shot on toward Vesta.

Even before the Terrestrial fleet had got into motion, the skinny Martian vessel had established itself just outside the detector screen, which protectively clothed the ice asteroid.

It waited, hovering quietly.

Far in the distance, the van of the approaching armada, which consisted roughly of fifty units, came into telescopic view. Those ships were beautiful, shining splendidly. Beautiful, too, were their interiors, with long, carpeted halls, and carefully polished metal work, and smartly garbed men, who busied themselves at their posts, making ready for the historic taking of Vesta.

The fleet came straight on, entirely ignoring the presence of the Martian man-of-war. The commander of that man-of-war, however, established communication with the flagship.

He said softly to Admiral Regarde: "You had best retreat."

"Are you offering resistance?" Regarde asked in amusement.

"Yes."

"One ship?"

"Yes." And added monotonously, "You had best retreat. There are ten thousand of your miles between us. Should you halve this distance, I shall destroy a few ships on the flanks of your formation." He said it calmly.

Admiral Regarde looked at him in scorn. Then he made a slight motion with his hand.

From the belly of the flagship was belched a small projectile. Radio-controlled, it moved through space, annihilating velocity.

The admiral began to count seconds. "Now!" he muttered.

Out there in space, a blinding brilliance was born, as a ton of virulent explosives burst against the enemy ship. For a moment the skinny man-of-war was obliterated in the glare; but when the glare was gone, the enemy remained.

The Martian commander asked innocently, "Was there an explosion? I seem to have felt a slight tremor. Ah," he whispered mockingly, "hundreds of thousands of years ago we of Mars outgrew such childish devices."

Regarde's face grew white as death.

A dozen projectiles, each as large as a single-passenger rocket ship, sped away toward their immune objective. The admiral watched tensely. He saw the explosion. The force was immeasurable. In spite of the airless condition of space, that sound simply should have been heard by the human ear. Five cities like New York could not have existed under the terrible concussion!

BUT it did nothing at all to the ugly vessel which blocked the Terrestrial fleet's historic taking of Vesta.

In the plate, the Martian had jumped to his feet, laughing in real excitement.

"There has never been a more beautiful example of futility!" he shouted. "Now, you must turn back! Turn back! Ah, your face whitens! You shout abuse at me! You quiver! Now you give orders to send your fleet ahead at maximum velocity!" Gone was the laughter. His thick, black lips twisted in a snarl. His face disappeared from the plate, but a certain promise had leaped from his ebon eyes.

On the flanks of the formation were

two battleships, gleaming with starlight, splendid representatives of Earth's space power. Now, as if they were but candle flames, something snuffed them out. The Martian ship had not evinced a single act of animosity, yet, when Regarde received the mind-shaking report, he could not doubt that the disintegration ray, long sought for on Earth, was part of the secret science of Mars.

He began to see a hideous possibility, one that he had never prepared for. But he saw some small chance. His first act after making a terrible decision was to dispatch a ship back to Earth, with orders that would bring out the reserve fleet. Six or seven million miles from Earth, the orders could be radioed. Then he urged his fleet on a maximum speed, diving blind into the most certain death trap ever conceived.

One at a time, his ships went. He pumped projectiles at the enemy craft by the hundreds. The stupendous forces hurled themselves with smashing violence against its flanks. But it seemed not to be harmed at all, save that it spun, or twisted, or moved slightly from its position, which showed that some of the force was getting through. It was this which interested Admiral Regarde. He suspected that Mars' sole defenses lay in that one ship, and he became obsessed with the necessity of its destruction. Vesta must not reach Mars.

He saw one way to annihilate the ugly ship, and that was by brute force.

In some era long gone, he knew now, Martians had perfected a system of force screens; they were using that system now, and no wonder the concussions couldn't get through! But most certainly it took a tremendous amount of power to maintain those screens.

He became hate incarnate. He loosed flood after flood of explosives, the only effective weapon Earth knew. His own ships went into oblivion with the regularity of clockwork, but he no longer cared.

The space Marsward of Vesta became a blinding inferno of flame and disruption.

THE ADMIRAL stayed seated on his jointed chair. He was childishly using his fingers to count his disappearing ships. He had quit turning over his command, in the event of his death, to other ships. What was the use? Those ships went too fast.

He could count all his ships on less than ten fingers now. Finally, when he muttered, "Seven. Wrong. Six," he heard a harsh voice in his ear. He sprang to his feet, his face distorted.

The Martian rasped viciously, "You fool! How can you hope to last? Turn back! Do you want to wait until it is too late?"

Regarde leaned forward, staring into those lidded, furious eyes, and whispered out of a throat that would not speak loudly, "Too late? For you? Are your screens holding? Have you enough power?" He laughed softly, wickedly, ending on a cracked note. He laughed louder. He began to scream. "They're breaking up! They're wabbling!"

The Martian staggered, caught hold of a projecting piece of metal. "Yes," he answered slowly, and added with soft venom, "but there goes your last ship. You saw the flash? Now you alone stand between my screen's eventual disintegration. In a moment, Admiral——" His eyes glittered, his eyes mocked. "Too late. Too late!"

The flagship sped alone through space, hurling an advance barrage of projectiles before it. "Too late," whispered the Martian through dry lips.

But a shocking convulsion crossed his face. Regarde, half insane, screamed in joy. He watched the Martian craft, and screamed again. At the critical moment, in this, the historic taking of Vesta, the dampening screens had given way under the unbearable floods of force

it had been nullifying, and a single projectile had exploded on the nose of the ship.

It was disrupted into a fine powder that spread itself over miles of space.

The single Terrestrial ship then hurled itself at Vesta. But its commander, half insane from both victory and loss, retained no presence of mind to remember a vital factor.

Up from Vesta rose scores of tiny ships. They dived headlong at the battleship. They were not equipped with the force beam which had stood the larger Martian ship in such good stead, but their numbers made a good weapon. A score of them were burst asunder from a single Terrestrial projectile, but the remainder sent a rain of similar projectiles back upon it.

The stout alloys of its construction could not stand the strain. It cracked in dozens of places, and those smartly garbed men in its interior fell in their tracks. A few were able to don air suits before the last of the air escaped, but they died anyway. The ill-fated last of the Earth fleet reeled downward toward the icy surface of Vesta, and crashed, awesomely, into a tangle of men and metal.

VI.

A SCORE OF DAYS passed, as if each was the spoke of a spinning wheel. Mars was nearer, now, hanging like a tiny red moon a few points off Vesta's line of movement—less than four millions of miles away.

As the days passed, the empress sent Will reports on the approaching Terrestrial fleet. Will's eyes clouded. Had she another ship? The empress' own eyes clouded. She was not so sure of herself now. Yes, she had another ship, and another under construction.

But Will was worried about Instar more than Earth, now. Earth had shown its hand, had been defeated. Now Instar was bound to act; probably he

had been waiting to see what Earth would do. But from what direction would he strike? That question was unnerving.

He seldom saw Bella.

He prodded Vesta on, with slow acceleration. And Mars came nearer. The days passed; nothing happened. Everything went so smoothly that for a while it seemed incredible. Then he began to feel a numb relief. He became possessed of the fantastic hope that his fears would prove groundless. The red planet loomed up, big, so near. Wasn't it possible— The heat in his forehead seemed to be passing away now, and the tormenting devils in his brain had laid down their pointed hammers. Forget Instar. He would be glad, glad indeed, when, at last, rain fell on Mars. He was tired, and he wanted to be done for a while, just for a while.

These were pleasant dreams.

One day Bella came running into the control room. She came up to him, her cheeks flushed.

"Will," she cried, her eyes unnatural points of excited brightness. She came up to him from behind, put her arms around his neck. "Will," she whispered, "I've been lonely—and desperate."

He stood up, wondering.

"But that's all over now," she went on rapidly. "Just put your arms around me for a while." She started to tremble. "You won't ever let me go, will you? I hope not. I've made such a mess of things. Falling in love with you!"

He started to say something, but she put her fingers on his lips. "Leave your work, for a while, Will. Will you do that for me? Perhaps it will be the last. Come over here. Don't they keep the suits in this closet?"

"Let's put one on, you and I. Let's leave this silly dome, with its machines, and let's go out onto the surface of airless, icy Vesta. We'll walk and look up

at the stars, and perhaps come ba— Oh, I don't mean that. I'm silly, excited. I want to be with you, alone. But you'll go?"

"Of course." He laughed happily, then frowned. The Earth fleet was due in a couple of hours. Vesta's lone protector should be out there now, waiting. Should he go? He decided it couldn't make any difference. He'd go with her; he'd be back in a short time. How could anything happen?

He gave the dome commanders certain instructions. They could do without him for a while; he'd been glued to this control board for too long a time now. He called an orderly, who helped them on with suits. They walked from the control room, out onto the metal flooring laid across the ice. He started toward the northern end of the dome. She pulled him straight ahead, toward the western.

Had they gone toward the northern end they would have passed the detector-screen transmitting room. That room was quiet. There was not even the sound of a snapping spark, nor the sound of a whining dynamo. The reason for this was simple: the main power cable had been neatly sawed through. Outflung on the floor lay three Martians, sleeping the sleep that little bombs of powerful anæsthetic will produce. A radio transmitter was still warm from recent use.

WILL AND BELLA entered the lock on the western end. The air hissed out, a valve swung silently away, into the airless night of Vesta. They walked through the opening and saw the white, jutting ice fields stretching out to a swiftly dipping horizon. They saw the brilliant veil of light, that was the stars, above them, a breathless splendor broken only by the numerous clouds, and wispy, nebulous streaks of opaque cosmic dust that for thousands of years have obtruded man's vision of whole

areas of the sky. They started running, leaping to fantastic heights.

Bella was laughing, feverishly. He heard it metallically, through the headsets, but he did not wonder very much about her strange mood. He was happy, happier than he had been in a long time. With her, he danced over Vesta's surface, laughing as he leaped to the apex of a sparkling ice pinnacle, shouting as he floated back into a depression at its base. They paid no attention to direction. They were able to leap miles at a time, for gravitation was a small thing on Vesta.

Everything was a fairy whiteness about them. Underfoot the ice reflected the starlight in innumerable points of fire. Sometimes there were prismatic effects, and then whole areas became iridescent, shining with all the bright, lovely colors of the spectrum. There were no shadows. The Sun was not visible.

Soon the domes, all five of them, dropped from view. Then they were running and leaping in a white mist that was loneliness alive. There was nothing at all save ice and stars, the stars seeming near or far, all according to the way you fitted your mind to it. They seemed atop a gleaming bowl, with the sides curving away rapidly to merge with the wispy star stuff of the sky; but far away, on the horizon, a red glow hovered—the jets, pushing the ice asteroid toward Mars. Water for Mars!

Bella leaped away from him in a parabolic arc. He leaned close to the ground, almost brushing it with his faceplate, and ran! She floated down from above, fantastically, grotesquely spreading wide her arms.

He caught her, but the momentum of her rush sent both tumbling gradually backward into an ice pit. He pressed his helmet against hers, grinning. She smiled back. She broke into a peal of laughter.

"Will," she gasped, and suddenly her eyes blurred. Tears came out of them, large, rolling rivers. A sob choked her.

"I'm so happy," she gaspingly explained. "Really happy, now. All this whiteness makes you forget things, doesn't it?"

He agreed that it did. He didn't care now, wasn't worried. Things seemed easy, unbelievably beautiful. No use to worry. Forget Instar—a myth, a fiction, an improbable figure out of childish dreams of horror. And Earth? He laughed at Earth, with its pitiable flotilla of imperfectly armed ships.

HE LAY on the ice, rolling over and over in an ecstasy of contentment. He started suddenly. What was that? The slightest shudder rippled under him, as if something had shaken Vesta. What was it? Was Vesta up to her old tricks, sliding around on herself? She was, by no means, firm; ice must get plastic at her core from the pressure, and then there were sometimes relocations of considerable masses. Must be it, surely.

He looked toward the horizon. The red glow was still there. Fears, foolish fears. He rolled over to face Bella, to look at her, to help him forget the senseless panic that was stealing over him.

Another tremor. And another! He sprang to his feet, cold horror seizing him. His heart was beating madly.

"Something's happened!" he rasped. He began to think, crazily. They were miles and miles away—a hundred or more. But the sounds, whatever they had portended, could not have been long ago. Those sounds had come ripping through the ice at 11,000 feet a second, ten times that of sound in air. Seconds ago.

Bella stood up. He held her, pulled her to him, all the while staring at the lingering red glow on the horizon.

"Will," she said faintly.

He paid her no attention. There was a thudding in his head, and all the tor-

menting devils had picked up their pointed hammers again. He started hopping toward the domes, and he heard Bella's words, though his mind would not let him comprehend their meaning.

"Will, don't go. Stay here. We'll stay here——"

He pulled her after him, but finally let her go. He went on toward the domes, grotesquely leaping and landing. He looked back once and saw her following, but he forgot her.

What a fool he had been to leave! The Earth fleet was up there. But Bella——

What was it he saw up there that occulted a streak of sky? A ship? A long ship! It dived down, lightning-like, was lost to view. He raced on, taking those gigantic, un-Earthly leaps. He topped a rise, after minutes, leaped far up into the white sky, looked down, at last, on the domes. A wave of dizziness swept over him as he saw them, white and gleaming and safe! Safe? He shuddered. Like loathesome, black-worms, long ships lay at the base of the domes. Their pointed noses had seemingly eaten their way through the tough alloys of which they were composed, for they were not visible. What had happened?

Instar! The ships had landed. Water haters had leaped out, with oxyacetylene torches had cut deep, circular grooves in the bases of the domes. The ships had leaped forward, crashed through the weakened section, had wedged themselves into the cavities, cleverly gaining access to the domes without causing damage to the vital mechanisms which pushed Vesta toward Mars.

A LONG LEAP, and Will floated through space, landed on top of Dome A. He clawed his way up to a transparent section, fell on his stomach, staring in panic. He saw the black nose of the invading ship spouting forth hordes of Martians—water haters.

Will's Martians had come rushing out at them, but they could not have been anything but unprepared. They doubled in their tracks. They fell, clawing at wounds which mile-a-minute projectiles tore in their bodies. They screamed, and the scream was drowned in the hoarse, bellowing shouts of the water haters, and the spitting sounds occasioned by the death weapons they held in their taloned hands.

Like an irresistible flood, they swept through the ranks of the protectors, thinning them out in a matter of seconds.

Will watched no longer. His head had frozen to a lump of ice, and his nerves, too, were cold. He slid off the dome, leaped across frozen water fields to another. Something made him look back. He saw Bella, silhouetted against the stars, looking at him.

He leaped atop Dome D, stared down, paralyzed, sickened. How had it happened? How had Instar managed access to Vesta? Hadn't the detector screen been in operation? Hadn't it? Or had it! A traitor——

What about the patrol ships? And then he remembered. There had been three garrisons, stationed equally apart on Vesta. Three concussions had come ripping through the ice——

He felt helpless. He could only watch. Everything was over now, everything. An inertia gripped him. The trend of events had walked on his mind, had numbed it into insensibility. Perhaps it was best, after all. Perhaps Instar was right, to a degree. And Earth? Wasn't he himself a damned traitor to Earth?

Slowly, he let himself slide off the dome, and landed on his feet on the ice. But he sank down until he lay at full length, looking through blurred eyes up at the stars.

If he could see now, see about a million miles out there into space, he'd see the Earth fleet, doing battle with Vesta's

protector. Protector! He laughed sneeringly, the sound coming strange and unnatural to his own ears.

Somehow Bella was standing over him. She was looking down at him, and her face was blanched.

"Will, my poor Will," she cried softly.

She dropped to her knees besides him. He looked up at her. A part of his mind was telling him the whole story now, but it was only a part; the other part was deaf. He felt that it was good to be lying here, to be released forever from mental torment, and to look forward with gladness to death.

She was saying something that somehow got through the mists of opaque thought stuff. But they were foolish things. "You can't lie here. Get up. Get up! Will, you've got to fight! Perhaps there's something——"

She pounded on his chest piece, screaming at him. "You can't lie down. What right has Instar, with his silly ideas! If it was Earth, but it's Instar!"

"Oh, it's no use," he muttered pettishly.

"Coward!" she snapped, jumping to her feet, her eyes blazing. "Are you afraid of Instar? Afraid to kill him? Look what he's doing to you! Oh, Will." She drooped over him.

He pushed her from him. He lay inert, thinking. Then he leaped off the ice, straight up, invigorated with a sudden burst of hate. When he came down again he was off with a snap of the feet. He could kill Instar! Kill him? Why not defeat him? —Yes.

HE BEGAN LEAPING toward the central dome, shouting back at her. She followed. The central dome began to leap toward him, fantastically. Its base landed at his feet. On the other side, out of view, lay the water haters' ship. He hurled himself upward, toward the transparent section. He panted feverishly. There was an air lock up here,

and he could get into the dome through the telescope room.

He worked a combination. The valve ground opened upward. He dropped down, a second later found Bella there in the darkness with him. The outer valve dropped; the inner opened. They went through into the observatory, passed the 40-inch refractor, emerged onto a balcony that overlooked the shambles below.

Without caution, he jumped, and hurled himself downward into the mêlée. His feet struck the head of a water hater, knocked him full length to the ground. Will snatched at the projector that bounced from the Martian's hand, aimed it at the Martian's stomach and pulled the trigger. There was a shriek. Blood spurted from the water hater's nostrils.

Will leaped toward the control room, fighting as he had never fought. Water haters—five of them—ringed him, a little dazed by his sudden advent into the conflict. Will shot them through the stomach, and shouted madly.

He ran across the metal compound that bridged the ice, turned and saw Bella flying in the wake of dying Martians he left behind. He dashed into the control room, waited for Bella's entrance, and then swung his stocky body against a heavy valve. It closed with a smash, cutting off the control room from the remainder of the dome.

Near the television cabinets, he saw three of his own men in combat with a half dozen invaders. He shot forward into the mêlée, killed two water haters by shooting them through the back, and from a third wrested a projector, which he tossed to one of his men.

Viciousness incarnate, he pumped high-speed projectiles into the invaders' faces, spurning delicate measures. Within the space of three minutes, the control room was cleared of living

occupants, save himself and Bella. His own men had died in the encounter.

He sat down before his television cabinets, jiggled a switch, hoping there would be a reply from the other domes, but there wasn't. Well, no matter; there were the auxiliary controls.

He jumped across to a receiver that did not need the convenience of a transmitter. He couldn't hope to get the domes that way, of course—too much curvature. But he wanted to find out what was happening up there in space. That combat was taking place on the Marsward side of Vesta, but if his relays still worked he could get at it.

AN IMAGE FORMED, hazily, took on shape, became a lacy shadow stretched athwart the stars. The Earth fleet. And over in one corner of the picture, just below the yellow, corona-incased disk of the Sun, hung a skinny, ugly ship, docile. He watched, saw those same almost-futile projectiles exploding with blinding, immeasurable brilliance, saw little flickers of light on the flanks of the Terrestrial formation.

He jiggled a switch, impatiently, fiercely, but no answer. Again! A gong rang. He halved the plate. The space battle dropped to the lower half; the face of the Martian commander appeared in the upper. He was scowling, but his face lighted. "Will Kair!" he cried.

Will stood up, shouting, "You fool! While you protect Vesta from the Earth, Instar creeps up behind your back!"

The Martian's eyes widened, both lids snapping up.

"Instar on Vesta?" he rasped. His voice broke. "What can we do!"

"A few subships, with your force beams!"

"As soon as a ship got through the immunizing screens, she would be blown up! It would be foolish! No ship could live through those concussions

without a screen. My small ships—Will Kair, even *we* will not live through it; but some of the Earth ships will remain!"

Will cut contact, swearing inaudibly. He eyed Bella hopelessly. She smiled. Her features were still that bloodless color. Her lips moved soundlessly, as if in prayer.

The room was shaken by a concussion. Will fell back against the television cabinets. Two or three more explosions like that would give the water haters access to the room.

Will thought desperately. His eyes lighted. He crossed the room to one of those giant semibrains known as an integrator. He began to pound keys. Minutes passed. The desperate rhythm of those pounding keys beat up a refrain: "Hurry! Hurry! Hurry!" And the refrain lent a nimbleness to his fingers and a keenness to his brain. "Hurry!" There was another vicious concussion. The machine ground out its uncanny mechanical thoughts. A final whirring, and into Will's hand fell a slip of paper. Twenty-one miles per second!

He went to the auxiliary controls, saw that the meters still recorded a constant firing. He began to notch switches over. Miles away, in the domes, fuel-conduit valves opened wider, but slowly. A rumbling began, coming up through the ice into his body. Another explosion shook the room. Will continued, calmly, inching down those finger-sized switches. The acceleration must not be too swift; that might mean the death of his hopes anyway; the increasing reaction might squeeze out the ice foundations.

A shattering vibration surged through him like the snap of a whip. He shuddered. Hurry! The minutes passed. He thought he could feel the very acceleration, now. He looked at the velocity indicators. Good! Three miles more to go! But if he only

had time to do it in the right, sure way. But he didn't. The room trembled. Across the room hung a picture of New York City. In effigy, New York City crashed into a thousand pieces.

With a final, scared look at the jagged streak of raw electricity that cut across between two damaged leads, Will disregarded all caution, forgot all possible results. He pushed those finger-sized switches down to the checks. In the firing meters, oil bubbled upward fiercely, filling the vacua above it.

VESTA rumbled deep in her bowels. The whole asteroid started shivering, as if a motor were turning over within her at a prodigious rate. Something dragged at Will, made him feel heavier.

He waited. A sheet of electricity began to play over the banked power units; drops of molten metal rained down in liquid, fiery beauty. Again the control room staggered, and then an entire side of it was blown inward, and swung for a moment as if on a hinge. There was a final, unbearable flash of power on the loose, as every tube and generator short-circuited itself out of existence. Will leaped back into a corner, his arms about the girl's waist.

Through the rent came leaping a score of Instar's legion, black faces distorted in anger.

Will murmured, still disregarding what his logic whispered, "I'm sorry you had to be dragged into it, Bella."

She answered emotionlessly, "Let me go."

She walked out in front of the oncoming pack. She held up a hand. She said, "Stop," in the Martian tongue.

They stopped before her, in a group. A Martian detached himself from them, walked up to her and growled, "What do you want?"

"I am Bella Devlin."

"Ah—Dr. Devlin?" The water hater stared at her, speculatively, then nodded

jerkily, as if in comprehension. He grimaced in slight mirth. He growled, "We shall not kill him, if that's the plea I see in your eyes. Your agreement with Instar did not include that."

VII.

HE STARTED WALKING toward Will Kair. Kair stared at him in fascination, his face paper-white. His knees and whole body began to shake. It was not that he was afraid, but only that Bella—

He stumbled forward, unseeing. Water haters circled him. They walked out the rent, onto the metal compound, detouring hideously mangled bodies. Will walked along, stumbling.

It seemed that he was walking forever in a dense, absolute darkness. He heard himself muttering Bella's name over and over. "She did all this," he heard a voice say. That was the part of his mind that had known it all along. "She did it all. She didn't want water on Mars. Neither did the water haters. But I did. I thought that sometime I would stand on the balcony of the empress' palace with her, and look at the green fields, and the white clouds, and the emerald ocean stretching across the horizon. But I didn't think this!" He began to marvel at his own stupidity, even while the pain of betrayal stabbed at his mind.

Will's captors walked swiftly, stoically. And behind them, unheeded, came the girl. She was not large. She had to run to keep up with them. Her face was streaked with tears, and her breath came in sobs. "Will," she whispered. But there was no reply. She continued to call his name, piteously. But, for the present, neither light nor sound existed for Will Kair, whose dreams had crashed about him.

She followed the group, and somehow, five minutes later, she found herself in a room in one of the water haters'

ships; looking across at Kair, who was chained to a pillar, as was she. She remembered entering the ship with Will's captors, of walking down a hall into this room, of seeing Will bound to this pillar.

Then a water hater had looked at her narrowly. He had said, "A woman will do anything to gain back the love of a man." And she had been chained, too.

She watched Will, wide-eyed. He was sagging against his chains, his chin on his chest. She couldn't know his thoughts. She didn't want to know them. She would scream if she did. It was bad enough to guess how murderous his thoughts were, to guess how he would like to put his fingers around her throat, and squeeze! And she wished he were free to do it.

So that, after an unbearably long silence, when he raised his head, and smiled tiredly, and said, "All right, Bella," every muscle in her body grew tense with incredulity.

"Will," she whispered. "You can't forgive——"

"Forgive you? Well, normally, I suppose I should summon a superhuman strength, break this chain with a flick of my wrists, and go over and grab you by the feet, and smash you against the wall. I don't suppose I'm normal, though. I can't make myself feel that way." He smiled. "Maybe it's because I'm too tired, or maybe because you are so beautiful."

"Will," she gasped.

"Your eyes," he told her, "shine green, like—like lakes in the mountains. But there's a look in them I don't like."

"Will, I—I——"

"Your hair," he continued, "is auburn, and agreeably rumpled. But you've been crying. But it doesn't detract, especially."

"I want you to know——" she began, fighting to hold back tears.

He frowned, but there was a spark

of amusement in his tired eyes. "Do you insist on explaining?" he asked gently. "I did this, against you and Earth. You did that, against me and Mars. So what does your arithmetic tell you?"

She slumped back and said faintly, "If I could only——"

"I begin to understand that man must not take anything too seriously. Because then he begins to have pains that can't be cured. Bella, if I had you in my arms now, your lips could not carve out a single phrase! There is so much I would like to say. But not about Vesta, and water for Mars. No."

"So we won't talk explanations. We'll just stand here, with our chains looped around us, and we'll wait, and look at each other, and I'll say a few silly, romantic things."

She smiled tremulously. "Silly things are so much better. You can say them if you want to."

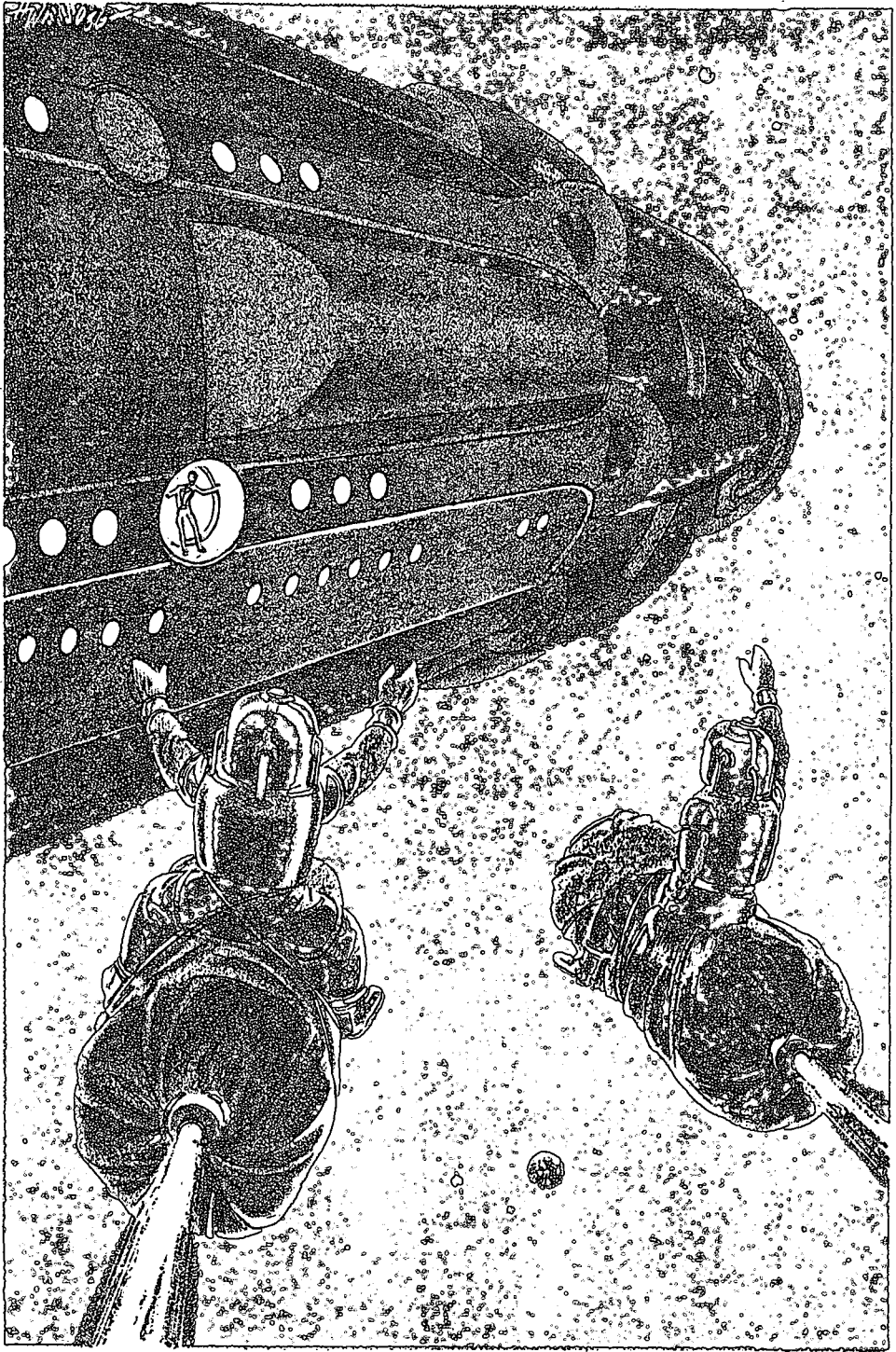
AN HOUR LATER, Instar came. He entered the room, pierced Kair with his utterly black eyes, ran a black, sharp-fingered hand over his head to put in place a straying strand of stiff, black hair, and cast a casual look at the girl.

He said, mockingly, "It is strange the way a man will set his strength against a cliff! Now you have failed, and I can see in your eyes that you were waiting for me, and wondering from what direction I would strike."

"You were a poison in my mind," Will admitted.

"That was as it should be." He glanced at Bella. "Will Kair, I will have grace enough to bestow my regrets that I found it necessary to use a woman of Earth in my plans. I found it impossible to place any of my own men on Vesta. Of all people in the system, it was only a woman who did not have to worry about the detector screen."

"The American Medical Association



They tried to get through the immunizing screen, but couldn't. As their strange fuel ran low they circled the ship. Suddenly an air lock opened—

had communicated their fears to the American government, but when I visited the acting head of the organization, he saw no reason why additional measures should not be taken. Deciding that a beautiful woman would most suit our purposes, Dr. Devlin was chosen. She was vitally interested, you see, in the benefits of radium to mankind, and, as has been proved, betrayal of her trust was impossible. She was on Mars when you left for Earth, and booked passage on the same liner."

"Ah," murmured Will, in comprehension.

"I sent Dr. Devlin to the asteroid, with instructions to wait for action on the part of the American government on Earth. If Earth failed, she was to act, but I did not seriously consider this possibility.

"Realizing, now, that Vesta was nearing Mars, I had to complete the chain. Having no funds of my own, and being constantly under the surveillance of the empress—whom I respect in spite of the fact that she entirely overlooks the welfare of our great race—I had no opportunity to construct ships. Thus I disappeared to Venus. Ah, you see. The water venders were anxious enough to construct a few ships for me, provided," he added, sneeringly, "that I did not ask for too many.

"So, even while that single ship blocked Earth's way to Vesta, I was hovering quietly on the other side of the conflict, awaiting the outcome. You understand that I did not dare break the detector screen in a dive to Vesta, for that would have brought utter disaster.

"When the space battle canceled itself, I expected Dr. Devlin to destroy the screen, and radio me an affirmation of her doing so. She hesitated for long weeks. But the affirmation finally came through. We plunged toward Vesta, dropped bombs into the garrisons the empress established here, and quite ef-

fectively obliterated the menace they presented. Of all weapons, surprise is the greatest."

He smiled. "And now we are here, and Vesta is captured."

"And now?"

"I discovered your excellent work of the few hours past. You have given Vesta the velocity that will enable her to coincide with Mars. At the same time, your rocket jets cracked, without exception, and I am quite certain they may never be used again. It was clever! Now I must use another means to keep Vesta from Mars.

"THE WATER VENDERS," continued Instar, sneering at the greed they represented, "have very kindly given me an explosive-laden ship. Quite enough to blow Vesta into about ten thousand small pieces. A few of these pieces, I grant you, will reach Mars. But the rest? They'll spread out through the system."

Will nodded heavily. He leaned back against the pillar, and his chains clinked a little. "What of me?" he asked.

Instar frowned. "You?" He started walking back and forth across the room, catlike. Some conflict of opinion in his own mind was evidenced by the tense lines of his black, hawk-nosed face. "I have decided," he said shortly, "that Mars shall be done with your particular menace forever. There may be other sources of water." His lips curled in a snarl of fanaticism. He snapped abruptly, "I shall leave you here."

He hesitated a moment, then took a key from his pocket. For a moment enigmatic thoughts flashed in his dark eyes. Then he unlocked their chains.

"You are free prisoners on Vesta," he said shortly. "You'll find no ship intact on her surface, and you'll go up with her."

"Bella Devlin?"

"I shall stay here."

Will opened his mouth in protest.

"She is right!" snapped Instar. "What do you think her thoughts would do to her if she left you here to die?"

Will nodded slowly, but the first trace of despair tugged his lips down.

Instar motioned them, and they went down the corridor with him. They left the ship from the nose, and Instar stood looking down at them.

He spoke to them, and, in compliance, they buckled on their helmets. A shadow crossed the water hater's face. "I am sorry," he muttered, "sorrier than I can say. No Martian possesses the barbaric instinct to murder another being. But you must die." He closed the air lock.

Minutes later, gauntleted hand in gauntleted hand, they watched furious rocket flames shoot from the ship's nose, saw it back out of the cavity in the dome, and later zoom away out of sight.

A strong wind began to blow as the air escaped. Air snow began to fall. They ran to the rent, and saw four other ships go flashing up into the misty sky.

Then, while the cold of space seeped into the domes, and froze everything solid, they sat down to wait.

VIII.

A DESTRUCTIVE BATTLE was occurring in space, beyond Vesta. Ironically enough, each combatant knew the uselessness of continuing the combat, since Instar had landed on Vesta.

But it continued, for the admiral of the Terrestrial fleet failed in his attempt to make a truce. He was in a fury. He had viciously established contact with the Martian commander, even as his ships hurled themselves forward toward Vesta's lone protector.

"Can't we make a truce?" he demanded.

"I do not believe it can be done."

"This is futile!" The admiral stood

up, excited. "It is a farce! We have never been at war with Mars! We have been fighting Will Kair all the while, and that's all there is to it.

"Now Kair is defeated. Instar has landed. You can never hope to land; your screens will come down. In the meantime, I will lose my men and my ships!"

"Lose them. You do not know that my screens will come down. Perhaps you have discovered a shortage of explosives. No, we must fight; the issue has not yet been settled." He cut contact.

The battle went on where it had left off.

In the meantime, a small ship, equipped with the most modern propellent system, flashed at terrific speed toward Vesta. Less than a week before, it had flashed away from the roof of the great Donlon Laboratories building, bearing a message so vital that the message bearer within, walking the floor of his room, bit his lips in furious impatience. It would be somewhat less than an hour before his ship reached such a proximity to the Terrestrial fleet that it could establish communication. In the meantime—

SOMETHING ELSE was happening in the meantime. On the other side of Vesta, a great, bulging ship, measuring a quarter of a mile from stem to stern, sleekly built up speed, and tore through space toward Vesta. Colliding with Earth, that ship would have gouged out a hole a hundred miles deep.

Watching it was Instar. He was contented now, and he hung in space, desiring to watch the spectacle.

IN A DAZE, while his ships disappeared one by one, the commander of the Terrestrial fleet hardly heard the gong that rang with desperate insistence. But after a while, he opened his receiver.

The figure of a man, gaunt and haggard, appeared in the plate. His eyes were wild. He stared at the admiral, and shouted madly.

"Cease this senseless conflict! It is useless!"

The admiral's lips twisted. "Yes!"

"What has happened to Kair?" the man in the plate shouted, his lips twitching. "To your ships? To Vesta? Is——"

"Instar."

"Oh, my Lord! This is irony!"

"We don't need those damned radium mines they've got on Mars. Let Will Kair flood her oceans, and flood the mines! Earth doesn't care."

"We've got Element 98, now!" he shouted, a proud light leaping into his mad eyes. "Donlon did it. Here are the proofs. You can see Donlon's signature, can't you? Donlon's been testing it for months, ever since he stabilized it. You can throw all your radium away, for Element 98 is radioactive, and does everything radium ever did in half the time, and does everything it never did in less than that! That's my message. And now——"

He fell over backward, into the arms of the pilot behind him. He had fainted. For a week he had been under the strain of fear that he would not arrive in time to save Vesta. For months before that he had known of Element 98, and what it might mean to the greatest altruistic mission ever undertaken: the virtual saving of the Martian race. And now—the irony of it!

Ten minutes after he had brought his message, hostilities between the two combatants ceased.

When he finally realized the truth the Martian commander forgot everything but that Vesta was in danger. He turned his ship, and dived toward it, hoping. Behind it came the Earth fleet, its commander anxious to assist against Instar. Will Kair had been a

traitor to Earth, but Instar was a fanatic.

Neither the Martian vessel nor the Earth fleet, however, was of any help to Kair or Bella Devlin, or Vesta either, for that explosive-laden ship struck the ice asteroid when they were barely five hundred miles from her surface.

There was a blossoming of light out there where Vesta was. It spread out and out, like a flower hung on the bosom of space. It was white, very white. The stars around seemed pale. Only the Sun could shine with such a ferocious brilliance.

For a while, as time goes, for æons as the mind of man and Martian saw it then, that white flower of luminescence suspended in space. Then its edges folded inward, curled in on themselves, revealing black other-sides. Those black other-sides, rolled in, approached the coruscating light core, and infolded it. Then the beautiful flower was gone. There was just a shadow that expanded until it began to break up into smaller shadows. Patches of light laced it into a gorgeous pattern. Then the shadows became insignificant. The light patches grew into each other, formed an unmarred sheet of light that was the stars. And Vesta, the ice asteroid, was never again seen by the eyes of man.

The admiral watched. His thoughts were unutterably sad. He looked at the spot where Vesta had been for about an hour. Then he had to withdraw his few remaining ships, for a chunk of Vesta came floating toward him. He turned back to Earth. It was the end of the story, the end of Kair, the end of Vesta, and the end of Mars' great hopes.

With the Martian commander, it was different. He switched on his weakened immunizing screens and sat there for hours, his heart crying. Vesta pieces went by him slowly. But he sat through it, trying to arrange his philosophy into the old, dull pattern.

IT WAS NOT, however, the end of Will Kair. Two hours before destruction had ripped Vesta apart, he had said: "Bella, do you want to die?"

"No."

"Neither do I."

"Why, then, let's don't."

"But there aren't any ships on Vesta to escape in."

She laughed. "You," she said, "asked me."

"All right," said Will gravely. "Here we are, free prisoners on Vesta, waiting for hell-fire and brimstone." He sat down on the ice, ruminating. "Instar is a fair example of his whole race, Bella—a little sentimental, a little soft. They've strained out all the barbaric traits. Instar is stronger than most, but he can't kill a man in cold blood. He wanted to kill me, but he didn't have the courage for it."

"Here's one part of his mind, saying, 'It is impossible for Will Kair to escape, and that's what I want. Every ship has been destroyed.'

"Here's another part of his mind whispering: 'If Will Kair wants to live bad enough, he will. If he doesn't find some way to escape from Vesta, I cannot blame myself for his death.'

"So Instar figures that if I am smart enough, I'll find a way."

He motioned to her. He began jumping toward Dome A. They entered. Will entered a warehouse, and put on his back a 100-gallon drum which was frosted over with air snow. He motioned Bella to do the same. They were light.

They loped across the dome to the other side, where Will found an apparatus the main items of which were a thick, jointed asbestos blanket studded on the inner side with many tiny, connected resistance coils, and a vacuum-insulated storage cell.

Will wrapped his steel drum in the blanket, and wired it up with the cell.

Then he stood back and waited for fifteen minutes. He turned the valve on the side of the drum, and a white substance, half gaseous, half liquid, shot out.

"Liquid oxygen," he answered the question he saw in her eyes. "Principle ingredient of the rocket fuel they use nowadays. But it wasn't liquid before I thawed it; we used this blanket and cell business to keep the stuff liquid while we took the drums between the domes."

"Now we'll escape, Bella, by using the reaction of the escaping oxygen. You only need a velocity of one eighth of a mile per second to get off Vesta, as compared with the seven miles necessary on Earth."

She surveyed the drum mournfully. "We'll get off Vesta, all right, but where do we go from there?"

"You asked *the* question." Will grinned. "But we'll wait for that until we get off the asteroid. Now hop aboard, and I'll do some work with these metal straps. I'll show a certain section of Instar's brain that you don't always need a ship to navigate space."

Later, they were laughing at each other; each felt monstrously ludicrous, straddled and strapped across the rounded backs of their strange steeds as they were.

Aided by spurts of oxygen, they hopped from the dome, out onto the glaring ice, with infinity spread around and above. Will took a last sad look at the havoc Instar had created, and then motioned Bella. Streams of compression-driven gas spat against the ice. They began to sway, as in a breeze. They inched the valves open. They started moving in irregular bumps and bounces across the ice, and suddenly they leaped away, moving at sizzling velocity. They accelerated, shot up into the sky. They hung on in frantic apprehension, guiding themselves by move-

ments of the body. The domes dropped below.

The whole asteroid dropped below. Soon the scarred works of man were hardly visible, and there was only the bluish whiteness of ice glaring up at them. The small horizons approached each other, and Vesta, at last freed of the corrupting influence of Will Kair, proceeded to shrink.

They saw the Sun, and, small as it was, it gave the illusion of being only a short distance away. The stars were glorious; but the utter absence of sound gave the spacial view a sinister, waiting aspect.

"All right?" Will asked.

"Scared."

"Keep going, and if that snowball down there begins to grow, you'll know Instar has done his worst."

She gasped, and burst into a muffled sob.

"Steady, now," Will murmured. "Don't say you're sorry, because you shouldn't be. Anyway, I have a hunch that duty and patriotism and moral rights were all having a rough-and-tumble fight inside you with—yes, I'll say it—with love. Isn't that right?"

"Yes," she whispered. "With love. When I'd satisfied the first three, somehow they went away. Then I tried to save you. Later I forgot all about everything—radium, Earth, Instar—and wanted to help you. And I did," she added sadly, "but only a little."

Will laughed, held his hands up to the stars. "Bella, the stars are grand! They don't look so far away. I feel as if I won't be afraid when—— But hold on!" he exclaimed. He was peering ahead at a space far above the Sun. "We should see that battle," he said slowly. "Or see the flashes of light, rather. But I don't see them. They've stopped, but why?"

"A truce?"

Will frowned. "Maybe. But it wouldn't be like a Martian to declare a

truce, even when he knew he was fighting uselessly. Must be something else, but I don't know what."

IX.

AT THAT MOMENT, Vesta exploded. Will saw the first blossoming of light out of a corner of his eye. He watched sadly and steadily, thinking outlandish, bitter thoughts. He sighed, finally, and turned his eyes away from the depressing spectacle.

He said, "We're two or three hundred miles above Vesta that was. Drum, three quarters empty."

"Does that mean——"

"Maybe it does. Unless the gods are with us. We are in a direct line with Vesta and that space battle. Now, suppose you were the Martian commander, with a terrible longing to see water on Mars. When you saw Vesta explode, would you turn around and scoot for Mars, or would you drive up close to the scene of the explosion?"

"I'd drive up close, because misery becomes exquisite when you increase it."

"All right, then, philosopher, we'll look for that ship."

She smiled. "I don't mind dying."

"Don't you? Well, I'm not trying to cheer you up. If we follow the general line between Vesta and the battle, we ought to see the ship."

They drove onward. Forlorn hope? No. Will, peering over a wide area in their course, saw, in addition to red Mars, and the Sun, and the white star field, a shadow growing on space.

"The ship!" he shouted. They shifted their course a little, and rocketed toward that long, skinny shadow. It came closer. They opened their valves to the checks, accelerating madly. What if it should leave?

But they reached it. They tried to get through the immunizing screen, but couldn't. As their strange fuel ran low, they spiraled the ship, trusting to luck

that a member of the watch would see them. And apparently luck could be trusted in this matter. An air lock opened, and in it stood a space-suited Martian, his face incredulous.

"THE DISCOVERY of Element said Will, "is a new mark in the line of progress. But the fact this discovery was too late to save makes my mind a shambles." He stood by a screen which showed and bitterly watched a Vesta fragment come floating toward the ship, only to slide off the immunizing screen.

Bella was at his side, watching him, self-condemnation infecting her thoughts. Will was smoking a pipe, in slow puffs. Abruptly, he stopped smoking; the smoke curled up, but the pipe died. He stood frozen, statuesque. His eyes were narrowed, as he stared into the television plate. The lines of his face tightened. He leaned forward. A Vesta fragment was approaching. He watched it. He smiled a little. He turned around. He turned his eyes on Bella, but she knew he was not seeing her. He was lost in the airy realms of speculation.

Finally, he spoke to the Martian commander: "Maybe—maybe we'll have water on Mars, after all."

"What?" the Martian breathed, blinking rapidly.

"What," asked Will Kair, "is our velocity?"

The Martian gave him a figure that approximated twenty-one miles per second.

"Same as Vesta's, before she exploded," muttered Will. "Of course. You set your velocity to that of the planetoid. Now, commander, I want you to compute the velocity of a single Vesta fragment, both at the beginning and limit of vision."

THE TASK was relegated to a telescope observer. The results were handed

back on a slip of paper. Will read them, eagerly. He laughed happily; a high flush came to his cheeks.

He dropped into a chair, sighing.

"It's going to rain on Mars; and because of a circumstance that Instar overlooked!

"At the beginning of vision of that Vesta fragment," he said rapidly, "it had a velocity of seven eighths of a mile per second; at the limit of vision, it dropped off to six eighths! Why? What caused it? What operated to make it forget the laws of inertia? What was there to stop it?

"I know, or I think I know! Once there was a planet between Mars and Jupiter. It exploded, and formed the asteroid belt. But why didn't the pieces spread out all over the system, out from the center of explosion, instead of forming orbits in a comparatively narrow belt?

"Because each fragment exerted a gravitational attraction on the others!" he answered himself, his eyes shining. "Those fragments had a tendency to pull each other back to a mutual center! In doing that they took up orbits about the Sun, some nearer, some farther. Finally, they formed a ring around the Sun, separated to a great extent, because the nearer a body is to the Sun, the faster it goes.

"Vesta fragments have a tendency to pull each other back to a mutual center! That's what they're doing now; that accounts for the falling off in velocity. Instead of spreading out and out in all directions, they're forming into a belt that's headed for Mars, at velocities on either the plus or minus side of twenty-one miles per second.

"Instar made his big mistake when he forgot the simple law of gravitation! And so," he said, in suddenly unsteady tones, "it's going to rain on Mars, after all."

The Martian bowed his great, black head, emotionally. Water on Mars! He

was unable to comprehend it. It seemed a dream, impossible of fulfillment. He thought of those terrible deserts, with their unutterably torrid, cutting sand storms. He thought of the low canals. He thought of his dying race. Everybody in the system had known that it was going to die; everybody, except Will Kair, knew there was nothing to be done about it. And now it would *not* die!

"Go back to Mars," said Will Kair, turning his back to the Martian; displays of emotion were a source of unease with him. "As for Instar," he added, reading the girl's look, "let him go. I wouldn't want to kill him, now, although maybe he'd want me to."

"You'll see Instar again," she murmured, with quiet conviction. "And he won't want to have you kill him. He'll want to kill *you*, despite the fact that you think he doesn't possess that barbaric trait."

A smooth acceleration put weight on their bodies. They went back to Mars, arriving there long before the first ice fragments struck the atmosphere.

SAVE at the bleak polar caps, all Mars was desert. Away from the very canal banks, in a monotonous vista that dulled the eye and wearied the brain; swept the sand. The inhabitants of the stately, aged Martian cities never saw anything but sand; maddeningly, it mingled with their thoughts, was with them in their dreams.

The skies were as maddeningly monotonous. During the day they were black, with a tinge of blue, and incredibly hot. At night, below-zero winds sprang out of them, and then untwinkling stars—and the two moons—began to wheel in great arcs from horizon to horizon.

What few varieties of vegetation existed were of a tough, fibrous nature. From them food was wrested. Together with this fact and the horrendous,

continuous struggle for water, it was no wonder the Martian race became depleted to the extent of a million in a single century.

No Martian, prior to the time of Will Kair, found himself able to look forward to anything save strife and frequent thirst. And if he wanted to go further than that, he'd see racial wars a thousand years hence.

Now, after these waterless summers, it was no wonder that they were on the streets of the cities, among their discordant, sand-roughened faces, and laughed into the heavens, and were seized by such a madness of joy that they knew nothing save that Will Kair had promised them water!

In from the hamlets on the edges of the sea bottoms came Martians by the thousands, seeking refuge in the uplands, in the capital city. All over Mars they were seeking the higher regions, for Will Kair had told them that within the next forty-eight hours, approximately 52,000,000 cubic miles of water was going to strike the atmosphere of their planet!

The empress stood on the balcony of her palace, beside Will Kair and Bella Devlin. Her eyes were turned to the heavens, rapt, yearning; her utterly black hands were tensely gripped on the granite railing, directly below which thousands of Martians shouted and gesticulated and sang, all waiting for rain.

A Martian came running to the empress' side, spoke excitedly. The first fragments, as seen by telescopes, had struck! They had been invisible to the naked eyes, being composed of ice. The eyes of the empress gleamed, and she began to murmur things to herself. But she watched the sky for hours, in anticipation of the untold treasure that was to fall from it.

Striking fragments became more numerous, seemed to double on themselves as time passed. Wisps of steam

began to form in the heavens. Slowly, they grew into tenuous clouds, that dulled the light of the Sun and the faint stars.

LATER, the clouds thickened, became black, ominous, delightfully menacing. They formed funereal milestones across the sky. The Sun struggled vainly to get its light through, and Vestal Light went down in defeat. The

Heaven became a hell of churning, the stars, steam. A fragment of horizon to horizon a black pall descended.

A strong wind, hot and moisture-laden, began to blow. It became a half gale; a gale; and then a storm. It swirled in eddies, sucking up sand, and then it seemed as if the deserts themselves were marching against the city. It swept furiously against the white buildings, scouring them whiter. It crept through the buildings, sifted itself through clothing, shot forcefully against impervious inner eyelids.

Lightning zigzagged across a full half of the sky; seconds later it was followed by a burst of thunder such as Earth could never experience. It began as a slow crackle, seemingly far away; then it built up as if it were squaring in volume. Thoughts were torn away by the awful concussion.

After that, it thundered continuously, and it began to rain.

The clouds broke open, and down came the rain, a mere spattering at first, that quelled the sand storm; the drops were small, a fine mist, but the drops grew in size, came down with ferocious force, almost horizontal under the strong wind.

Martians ran for the shelter of the city.

The rain came down in solid sheets, in rivers, in oceans. It came down into the open-roof dwelling. It sifted through the floors until it began to pour out the little windows, out of the doors,

out of every crack it could find. It seeped through the lower levels, gushed out into streets, which even then were shallow rivers.

Out beyond the city, nothing could be seen save water. The deserts were no longer deserts, the skies no longer skies. Both were oceans, the latter but an inverted variety. Broad, jagged bands of light cut that hellish sea, in misty relief lighted the sand-dirty tide that roared and bellowed over the deserts and through the cities.

The canals no longer existed. Sand dunes were gouged away to a common level.

THE Empress of Mars stood on the palace roof top, stretched her thick arms yearningly up into the sky, and wept softly, though she did not know it.

All Mars was being drowned in the deluge.

A ferocious wind grasped the oceans of water in its hand, and flung them about with little regard for direction. It swept up the sand, mixed it with water, and smashed it against the white edifices of the Martian cities, and against the people that thronged their roof tops.

Smaller hamlets, long since evacuated, were swept down into the sea bottoms, along with the voracious flood that was filling them. Solar power stations were borne in whatever direction an utterly mad system of conflicting currents chose.

Marsport became less than nothing.

Thousands of Martians—those who for various reasons had not subscribed to the warning given them—were drowned.

But no one cared. For these few hours in Martian history no one cared about anything.

No one even spoke, for he could not; there was too much thunder mingled with the slashing cacophony of the rain. But he could laugh; if he could not make himself laugh, he could weep. If he was not standing still in the rain,

then he was awkwardly trying to swim in it.

If the light of neither stars nor moons shone through to light the planet, then the lightning seemed a more beautiful thing to watch it by. If a building began to tremble or lean dangerously, no one could know it. If it seemed that the very planet was being eroded away by the torrents from the sky, it could not possibly mean much to the people, who had not known water for thousands upon thousands of years.

There was water on Mars, untold quantities of it. There would be rivers, lakes; the heretofore dry ocean beds were filling, and soon the draining deserts would be green; later there would be clouds lacing patterns across the heavens; later would come moisture-laden winds.

And so it rained as it had never rained on any other planet. For seven days Vesta's fragments bombarded Mars' atmosphere. Some were late in coming; some missed by ten to twenty thousands of miles, but the red planet, avid and waiting for her celestial drink, reached out gravitational fingers and drew them in.

IT WAS on the morning of the fifth day that Instar came. It was still raining with violent vigor; thunder was mingling with the moan of the wind, and the gushing mutterings of the angry tides, and the steady, deafening roar of the flood from space.

Will hardly saw the ship before it landed on the roof top, not a hundred feet away from the shelter under which he, Bella, and the empress stood. He stared, for what madman was it who could live through the violence of that wind and lightning?

The thought came to him that it was Instar. He stared at the ship. An air lock opened. A Martian leaped out. The rain beat down on him, and the wind threw him back against the ship

again. He staggered upright, started running across the roof, leaped down a full ten feet to the balcony, crouched there like an animal.

He saw Will Kair. He started looking at him. His black eyes became luminous with frightful hate. His head drew back in a snarl. With that look unnerving, bestial, sidling close death came toward Will. He held a dagger in one hand, but for some moment he dropped it.

He stopped, muscles about shouting twitching. For several moments he made no sound, nor did he move. The orchestra in the sky screamed upward into a frenzied shuddering of sound; the sound exploded with nerve-jangling force, dropping into a weird, voluminous whisper.

Instar said: "There is water on Mars. And you have brought it here. Why did you do it? Don't you know my heart is cracking from the thought of it? That I have gone mad from the pain of it?"

"You see what you have done to Mars." His chin began to tremble, and his lips to work. "Now there is water on Mars. Now we are done. You have washed our greatness away on your water, and our ideals shall rot. Now there will be wars. Now there will be disease. And what I am to do?"

He began to sob insanely. He hid his face in his hands, as if to shut out the shame of water. There where he huddled, with the drive of horizontal rain beating against him, he sobbed and choked out a sorrow that was turning into a bestial rage.

He straightened abruptly to his full seven feet. He raised his arms above his head, as if supplicating some deity, and then snatched them down, as he beheld the upside-down ocean in the sky.

He walked toward Will Kair, who stood motionless in one spot, his features immobile. The monstrous Man-

tian madman stalked toward him through the rain.

Thunder crackled, deafeningly; lightning played over the whole length of the sky. And when the thunder was a whisper, Instar shouted, "Water for Mars! It's here! Your dream is going on, but mine is—finished. But how do you think your water will treat you?" He screamed, and hurtled across the space separating him from the object of his hate.

He struck Will with his body, by sheer impetus knocked him from the shelter under which he and Bella and the empress had been standing before the advent of Instar. He staggered backward, out into the rain, fell against the balustrade of the balcony.

Will jumped to his feet; suddenly swept away by an inhuman anger. He smashed the water hater repeatedly with his big fists, but he was fighting a seven-foot madman.

Instar roared above the roar of the rain, picked Will Kair up in his hands and flung him toward the balustrade. Will hurtled through the air, struck the balustrade, lay across it, inert, unconscious.

With one powerful leap, Instar landed beside him, picked him up in his great, taloned hands. For a moment Will Kair swung like a pendulum, at one moment hanging above a blackness that stretched

downward for a thousand feet, at another hanging over the tiled flooring of the balcony. Then some quirk made Instar lay him down again.

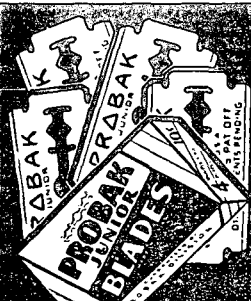
Then Instar stood on the edge of the balustrade, facing the east, challenging the force of the wind. He screamed insanely at the aquatic catastrophe that had overtaken his doomed race. He waved his arms at the lightning and the clouds and the spacial rain, cursing them all in virulent, profane language.

Bella walked to the balustrade like an automaton. She raised an arm. She placed her hand against Instar and pushed with her greatest strength.

Instar toppled, clutching wildly at the air. He spun half around, a horrified expression making his face a hideous thing to see. He screamed terribly. Like a tall, crumbling building, he fell slowly off the railing, down into the invisibility below, and was lost to sight. His screams echoed up, were snatched away by the storm.

Bella clutched a hand to her forehead faintly. Through a thousand feet of rain and wind, and finally into the river of water that swept through the streets of the city, Instar fell, to be borne away to the rising seas.

AT THE END of the sixth day the rain began to lessen. The clouds began to thin, the thunder to cease. At dawn



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4

BLADES FOR 10¢

PROBAK JUNIOR

of the seventh, the Sun could be seen pushing itself up over the misty horizon. It shone through murky red, lighting the planet with a dim, bloody color. As far as eyes could see in this gloom, the deserts were swirling floods, slowly draining off to the sea bottoms in the east.

The rain became a fine mist after another day. The clouds lost their ebony, became white. The floods subsided, revealing gouged, eroded deserts. In place of the canal that pierced the heart of the city, there was a churning, dirty river, madly sloping off to the east.

On that morning, the monstrous Empress of Mars stood majestically on her balcony, surveying her glorious new planet. She babbled like a child. Her thought rambled.

When Will Kair told her that the polychromatic bridge stretching through the mist was a rainbow, she began to cry and laugh at the same time.

Will pointed toward the eastern horizon. "Isn't there an emerald sort of sheen out there, Bella? Stretching all along the horizon? That's an ocean."

Her greenish eyes misted over. "Will, you—you've done so much for Mars! But at the expense of losing Earth. Will they—take you back?"

A rumbling voice answered harshly;

the empress had turned away from the rainbow. "They shall take back Will Kair!

"The mind is a strange thing!" she exclaimed. "Those people of Earth shall learn that Will Kair fought not for an alien people, but for a race related by blood to their own.

"They shall also learn," said the empress, "that right and wrong are easily confused terms—for there are always circumstances which force each to partake of one half the quality of the other."

She turned away from them, to stare in fascination at this incredible new world which Will Kair had created for her.

"I don't care if they don't take me back." Will smiled.

"Because?" asked Bella.

He took her in his arms. Over her shoulder he turned his face upward, letting the rain trickle down it, and into his parted lips.

She hid her face in his neck, started to tremble. She was thinking of how she had betrayed, but she told herself that that was something she must forget. It could gnaw the meat out of happiness, if she let it do so. Will Kair had forgiven her; she would remember that.

Next Month:

Visitors From The Void

A new, fascinating, instructive science article

by WILLY LEY

Author of: "The Dawn of Conquest of Space"

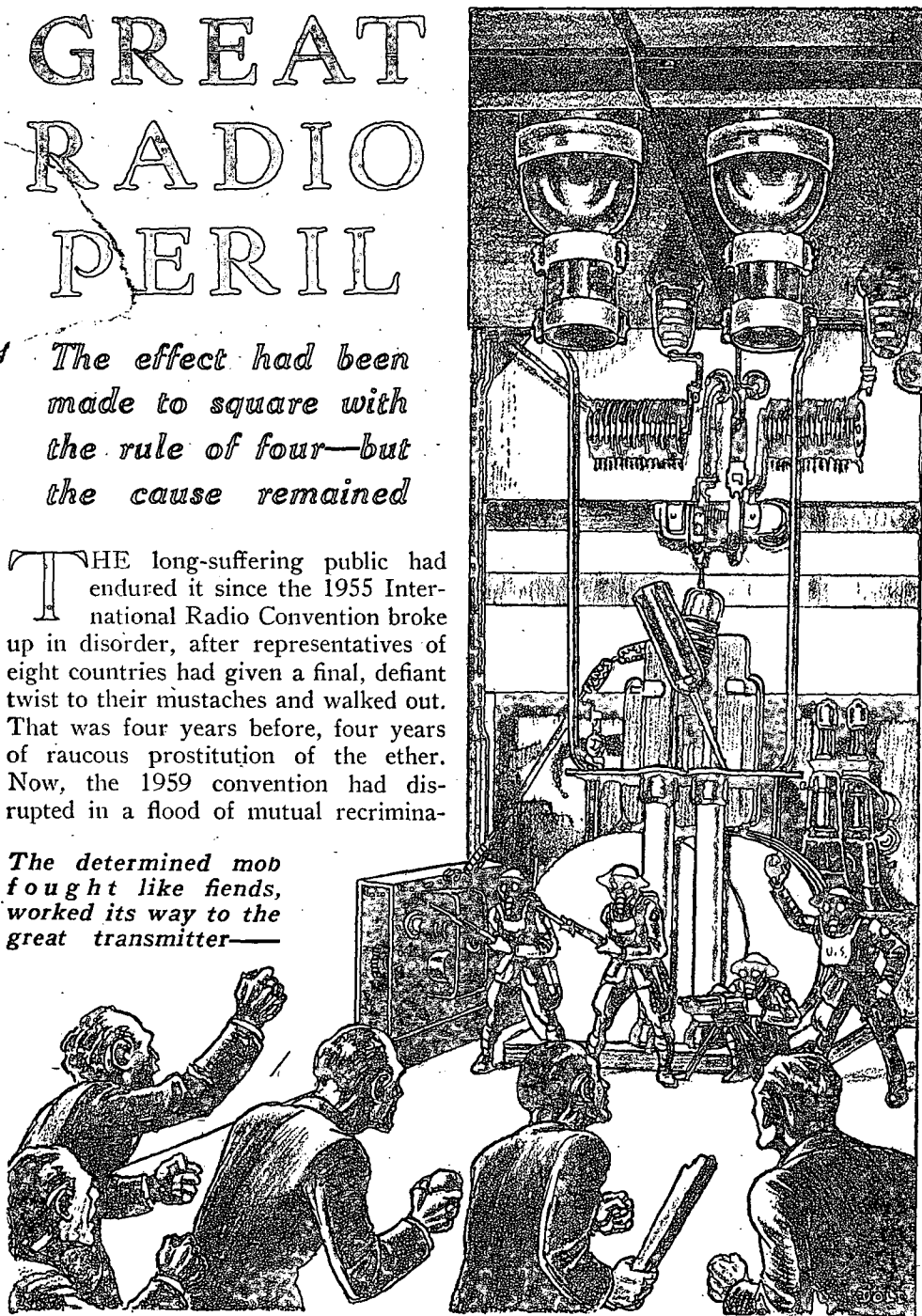
The GREAT RADIO PERIL

by Eric Frank Russell

The effect had been made to square with the rule of four—but the cause remained

THE long-suffering public had endured it since the 1955 International Radio Convention broke up in disorder, after representatives of eight countries had given a final, defiant twist to their mustaches and walked out. That was four years before, four years of raucous prostitution of the ether. Now, the 1959 convention had disrupted in a flood of mutual recrimina-

The determined mob fought like fiends, worked its way to the great transmitter—



tions. The listener sat in front of his receiver and bowered the wrath to come.

Within a week seven European countries had doubled the power of their chief transmitters; within another week ten more countries had retaliated. Radio was too useful a weapon of propaganda to have its edge dulled by rivals. The already powerful Deutschlandsender boosted itself to the unheard-of strength of twelve thousand kilowatts. Moscow followed suit. Prague tailed after. Every nation made up its mind that it was degrading to the national spirit to allow itself to be outshouted by neighbors. Great Britain knocked down its recently completed *Voice Of Albion* and proceeded to replace it with what was expected to prove the biggest noise ever.

Stations crammed the air cheek by jowl, bellowing, bawling and treading on each other's corns. Manufacturers of radio receivers worked desperately to provide the public with sets having a guaranteed selectivity of two kilocycles. Some did it; some didn't, and the successful ones were not much better off than those who failed.

In countries where radio transmission was the favored child of commercial advertisers, price of time on the air became determined by the power of the station used as well as by the period of time taken up. It cost twice as much to extol the virtues of laxatives from WRSA as it did from WBGZ. Where radio was a government-controlled monopoly the public, as usual, had to take what it was given and like it or lump it. Those who just couldn't take it spun the dial and let a foreigner throw it at them. Propaganda was the mainstay of the daily program, each day and every day. Voices sharp and sure, mellifluous or pontifical, dinned into a multitude of aching ears the benefits of this "ity" or that "ism."

The daily press, or part of it, took due note of the babel. Publications whose policy disagreed with that of local trans-

missions gave space to hundred of protesting letters from irate readers. Those whose policy was completely in accord with broadcast hokum found space for such missives in the editorial wastebasket.

Press interest in international-radio mania died out when a Mrs. Artiglio Spotti suddenly gave birth to a family of six. The little man who served behind a counter, piloted a brewer's dray, or rushed to catch the eight twenty-five to the office every morning, was forced to surrender his views anent radio and take an interest in what the sextuplets were fed upon, how they were given it and who gave it 'em. Left-wing sheets dropped their acidulated comments concerning wireless jabber and indulged in odious comparisons between the lots of those born singly and those who came wholesale.

IN JUNE the subject of the moment was food. For some unaccountable reason crops were unsatisfactory. Nature had failed to do her stuff in the manner humans felt they had a right to expect, and the same phenomenon featured over most of the world. Potatoes had flopped; rice crops were fifty per cent below normal; fruit attained luxury prices. China squinted at a quantity of soy beans hardly worth calling by the name. Britain wondered what was happening to its grass and why its hedges were creeping back into earth. Artichoke racketeers in New Jersey looked around for a new medium of iniquity, when artichokes abruptly ceased to be. Italy reaped no cereals, but harvested a crop of lemons the size of gooseberries.

As the year wore on matters became worse. The United States wheat crop failed dismally and was reported the poorest in history, the price of bread skyrocketed; the cost of living bounced up with it. News leaked out that Elmer C. Schnaksdof, a minor broker, had purchased twelve million bushels of

wheat on behalf of the Federal Reserve Board. This was practically three quarters of the quantity on the market. The Chicago Wheat Pit remained open all night, while raving brokers fought for the last barrowload.

Next day, wheat was not quoted. British bakers put up the price of the four-pound loaf to four shillings and sixpence. The rise in other countries was equal or higher. In ten parts of the world ten armies of unemployed set on hunger marches. In a thousand factories the hands downed tools and demanded higher wages.

Two more months faded from the calendar, and the food problem had assumed the aspect of an international crisis. Famine struck shrewdly at heavily populated and uncivilized districts. A horde of natives from Central China paid their first visit to the sea via the turbulent, yellow waters of the Yangtze, their sightless corpses swollen as they had never been in life.

Transmitters of the world blared more blatantly than ever. Thundering voices exhorted, cajoled or browbeat the helpless populace, offering a million reasons, a million cures. Technocracy blamed capitalism, capitalism blamed communism; communism passed the buck to the Yellow Peril. Atheists asserted it was the natural result of two thousand years of Christianity; Christians attributed it to general unbelief.

Churches, chapels and tin tabernacles became packed to their doors, as frenzied congregations battered at the gates of heaven with storms of unceasing petitions. In the Far East a multitude of prayer wheels whirled out their endless *O miné padme hum!* Every street corner had its prophet predicting death, desolation and the end of all things. As the year entered into its prime the Four Horsemen flung themselves into saddles and spurred through the woods and the dales.

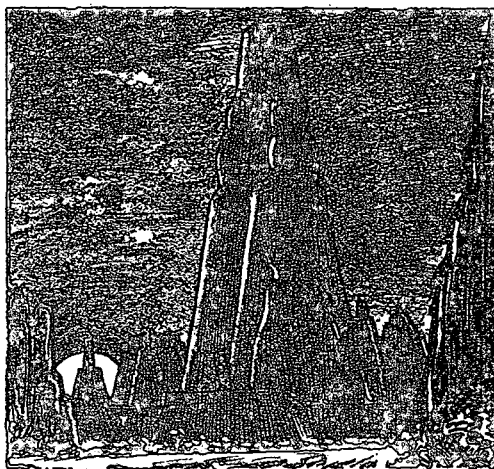
AST—4

IN LIVERPOOL the Hop Sing Tong gathered together the pathetic remnants of its funds, hired a boat and sailed for China. Its members had been quite worthy citizens, but they felt that if one is to starve to death one must hasten to secure burial in the land of his fathers. Ten days after Chinatown had emptied, a great procession wound snakelike out of Liverpool's slums, crawled along the euphemistically-named Park Lane, and slithered to the center of the city. Here it recoiled before a cordon of police.

The head dissolved into component individuals. The windows of a tool merchant's shop were smashed; growling men grabbed giant spanners, pick helves and rods of steel. The head reformed itself—fanged this time. It struck ferociously, scattering police like chaff before a wind. Unhampered, the snake writhed forward and encircled a great department store.

Police mustered inside the store behind locked and barricaded doors. The mob moved back to gain momentum, set itself for the rush, then crashed headlong into the shop, carrying doors, barricades and police buoyed up like flotsam on the crest of a roaring wave. Scenes of absolute confusion followed.

On the second floor, in the lingerie



department, a frantic, half-stripped constable viciously batoned a dummy that fell upon him from a stand. In the food department, in the basement, twenty of his fellows fought tooth and nail for dear life. Clad in a commandeered fifty-guinea fur coat, the beefy wife of an unemployed butcher's assistant felled a police sergeant with a sixteen-pound leg of roast pork. Brandishing the joint in one enormous fist, her face purple, she cut a swath through the howling mob, spattering with fat and cracking every countenance that thrust itself into her path.

The 8th Battalion Mersey Rifles marched out of headquarters with tin hats and fixed bayonets. They reached the store half an hour too late and found it an empty shell standing in littered streets. The 8th Battalion Mersey Rifles made one capture. This was a furtive gentleman who sidled past them hugging a loosely wrapped parcel to his breast. He turned and ran like a hare when suddenly the parcel chimed and struck six. A lanky corporal outpaced him and the clock was added to two other souvenirs; banners inscribed "We War Food" and "Prepare to Meet Thy God."

In Glasgow a number of startled Glaswegians witnessed the Battle of Springburn, a bloodthirsty fracas madder than any since the heyday of the Knobbly Boys and Gashouse Gang. Sheffield made good use of its own razors, cut and carved its way to hidden stores of food and did it with fine indiscrimina-

tion. The Red Belt of Paris tightened about its middle; plate glass worth millions of francs dissolved to splinters under the pressure of hunger.

Berlin, Madrid, Athens, Rome, Lisbon, Cairo and every other place big enough to have a taxi by its station became the scene of wildest tumult, as citizens sought nourishment. One after another, governments became tired of

seeing policemen tossed around and declared martial law.

Disciplinary declarations were good enough for the purpose of maintaining order, but they compelled no grass to grow. It didn't matter a tinker's cuss whether the declaration was signed by a plain mister or enunciated sonorously by a right honorable, not one bush produced an extra nut in consequence. Armed troops dragooned the populace in the streets; radio bossed them in the homes. The effect had been made square with the rule of four. The cause remained.

NEWSPAPERS had forgotten the sextuplets and returned to the subject of eats. Fifty of the more high-brow sheets ran special articles purporting to show, in a scientific manner, how diet influenced evolution. The hungry world was told in pedantic phrases that wheat eaters had it all over rice eaters. One British paper was suppressed under the Incitement To Disaffection Act, when it quoted from the unpopular philosopher Revair: "Life is simply one great belly—who strikes at the belly strikes at life."

In the United States, at Springfield, Mass., a silent, determined mob fought like fiends and overcame a detachment of the national guard. The encounter was bloody in the extreme; the mob was not to be denied and had its way despite tear gas, vomit vapor, machine guns and other instruments of correction. It wrecked the great N.B.C. transmitter, then made for the stores.

News of this particular incident dribbled slowly around the world, and set in motion a rumor that radio was to blame for the failure of crops. Professor Howard Blakoe, physicist at the University of Delhi, heard the rumor and marveled that the connection had not been perceived long before. He decided that the time was ripe to put forth a stronger effort to tell what he had been

trying to tell for weeks. He wrote a long, technical article, passed it to his literary agent, who, to his astonishment, found it accepted by the *Times* of India.

The staid and highly conservative *Times* had no views of its own about the matter, retaining a purely academic interest in a subject that had the virtue of persistent topicality. So the article was printed. It was also syndicated and reappeared in twenty other publications. To Blakoe's disappointment, it did not excite the world-wide interest he had expected. After all, a score of papers reached only the fringe of the reading public. He had the small satisfaction of receiving a few encouraging letters from fellow scientists, one or two of whom announced their intention of seeking evidence to confirm his theories.

In his article Blakoe made reference to Jungman's experiment, in which that noted research worker had shown that capillary action could be hampered, and even prevented, by the influence of powerful radio waves ranging between twenty and four hundred meters in length.

It was Blakoe's theory that when they reached a certain concentration radio broadcasts caused electrolysis of the surface molecules of plant liquids, thus breaking surface tension and hampering, or preventing, capillary action. He pointed out that plant life depended upon capillary action for the free flow of natural juices, and that animal life was dependent upon plant life. He concluded with a warning and a suggestion that were both ignored: destruction of plant life would result in the elimination of humanity, unless the world reduced the power of its broadcasts to below the danger point.

One scientist read Blakoe's article and waxed sarcastic. He wrote to say that he was living within five miles of the great Toulon transmitter, but his capillaries were still working O. K., thank you. Fourteen junkers of various na-

tionalities forwarded missives telling Blakoe that they saw through his little stunt, and that India was not going to persuade everybody to drop out of the ether and leave it clear for her. Blakoe perused all his mail, came to the conclusion that the way of the reformer is hard, and decided to leave the matter in the hands of his few supporters.

ANOTHER MONTH trickled into the bottom glass held by Old Man Time; news of the world featured riots and upheavals daily. The *S.S. Aoraki* arrived at Hull from Samoa, bearing a cargo of copra. Former workers at a local soap factory informed the uneducated that copra was dried coconut flesh. Hungry people did not need to be told more. The *Aoraki* was raided and her cargo dispersed with lightning speed, while her police guards gave an aquatic display diving from the dock.

During the same week half the world tumbled to the fact that manufacturers of cattle food held large stocks of locust beans. Not a bean was obtainable by the following Saturday. In every country works and factories closed down, as employees found it necessary to seek and take by force those things wages could not buy.

Congress sat in Washington and considered a proposal for another radio convention. Two hundred lobbyists, representing American stations, used all their power and influence to see that nothing was done. Outside the White House a simple citizen tried to distribute copies of Blakoe's article and was flung into the gutter by a cop.

The British Parliament assembled at Westminster to consider a radio proposal emanating from Washington. Seventeen representatives made speeches defending the broadcasting rights of the fighting forces, the clergy, the theatrical world, the department of propaganda, and the Union Jack. One holder of a

radio permit, seated in the gallery, showed a handful of leaflets on the floor of the house. The leaflets were reprints of Blakoe's article. The vulgar objector was hustled outside the sacred precincts.

Britain's parliamentary discussion ended in a decision to double the power of the new *Voice of Albion*; Congress deliberations resulted in the dispatch of a stern note to Soviet Russia.

The Mayor of New York looked along Broadway and saw it strewn, not with ticker tape and torn telephone books, but with buttons, belts and pieces of ripped clothing. The Sheriff of Cheyenne County, Wyoming, was shot as he defended the last sack of flour in a bakery. Japan severed relations with Argentina after a Rosario newspaper had printed a photograph of a half-eaten baby, captioned as an example of what was taking place in Yokohama. Forty-four millionaires departed for the South Sea Islands, when news leaked out that Polynesia was the only portion of Earth unaffected by the canker. The love story of Hiné Moa became a snigger-provoking anecdote for stag parties. Civilization lost all refinement.

The very severity of this world-wide affliction brought about its own end. It contained within itself the seeds of its own destruction. Half-starved or wholly starved people could no longer purchase radio receivers, while those who had them could not afford to run them. Radio manufacturers the world over experienced an unprecedented drop in sales, which filled them with alarm. Nations that derived revenue from use of wireless sets found their income shrinking rapidly toward the vanishing point.

THE ASTUTE EDITOR of the Little Rock, Arkansas, *Daily Searchlight* had long blamed radio competition for the paucity of advertisements in his col-

umns, and he decided that now was the time to do something about it. He commenced by giving front-page prominence to Blakoe's thesis, and supported it with an acidulated editorial which, in essence, was a violent attack upon radio transmissions.

A large number of contemporaries followed the lead of the Little Rock sheet, and Blakoe's half-forgotten theory came before a bigger public. Sudden press antipathy to radio was not due to real faith in Blakoe's notions, or to any desire to support the Arkansas editor, but to falling circulation as the public spent their pennies for things more necessary than newsprint.

The Little Rock paper's next scoop took the form of a letter from the Bose Institute at Calcutta. Dr. T. Runga Rao was pleased to inform the editor of the *Daily Searchlight* that the institute had been endeavoring to find evidence in support of Professor Blakoe and had met with some success. Measuring of plant exhalations had shown that the output of plant breath was forty per cent greater than that of twelve months before and, what was much more important, the output was exceeding the intake. Samples of subtropical vegetation, imported from Palmerston, Cook Islands, had thrown off more gas and become shriveled and stunted when reset near to the huge antenna of Calcutta Station. The Bose Institute was satisfied that radio was causing partial electrolysis of vegetable juices.

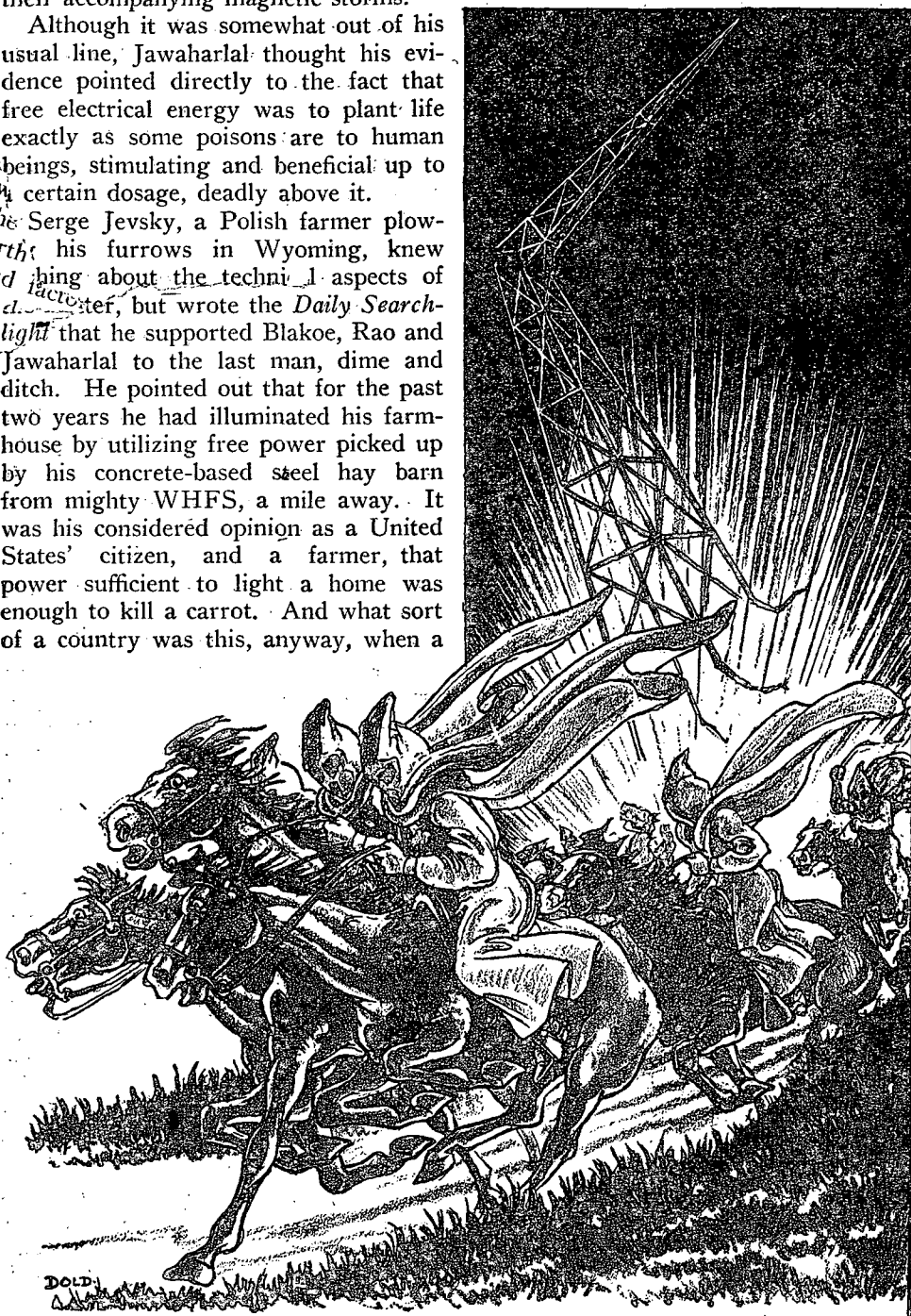
Almost by the same post the *Daily Searchlight* received a letter from Dr. E. H. Jawaharlal, astrophysicist at Kodaikanal Observatory. Jawaharlal said that he had been corresponding with Dr. Runga Rao, and he thought the editor might be interested in a couple of graphs. The graphs showed variations in solar radiation over the broadcast bands during the previous ten years, and the incidence of crops for the same period. When studied side by side the

graphs showed clearly and unmistakably the remarkable reaction of vegetation to the appearance of sunspots and their accompanying magnetic storms.

Although it was somewhat out of his usual line, Jawaharlal thought his evidence pointed directly to the fact that free electrical energy was to plant life exactly as some poisons are to human beings, stimulating and beneficial up to a certain dosage, deadly above it.

the Serge Jevsky, a Polish farmer plow-forth his furrows in Wyoming, knew sand hing about the techni 1 aspects of and d. lacter, but wrote the *Daily Search-light* that he supported Blakoe, Rao and Jawaharlal to the last man, dime and ditch. He pointed out that for the past two years he had illuminated his farmhouse by utilizing free power picked up by his concrete-based steel hay barn from mighty WHFS, a mile away. It was his considered opinion as a United States' citizen, and a farmer, that power sufficient to light a home was enough to kill a carrot. And what sort of a country was this, anyway, when a

Hooded figures landed a shattering side kick on the nearest transmitter and vanished like wraiths—



DOLD

feller's wheat got electrocuted every time some fat capitalist sprayed the air with a tooth-paste ad?

TO WHAT EXTENT the great American public followed the academic discussions of Indian scientists will never be known, but Jevsky's cry from the heart met with immediate response. The *Daily Searchlight* printed a round twenty confirmatory letters from agricultural gentlemen who were not afraid to call a spade a ruddy shovel. The editorial told readers that these letters were merely a selection from two thousand received that week. Other papers followed suit.

The Grand Dragon, arrived suddenly in Birmingham, sent round the message of the Fiery Cross and mobilized overnight the Alabama Legion of the Ku Klux Klan. It was the first time they had got together in fifteen years, and they made up for lost moments. They swept through the streets of Birmingham like the hordes of Jenghiz Khan, picked up N.B.C.'s "Sweet Singer of the South" and sprinkled it around the outskirts of the city. With a thunder of hoofs they crashed into Tuskegee, played with dynamite and bounced its little relay station against the glowering clouds.

Next day the Ku Klux Klan put over a special tri-State demonstration. Under the personal leadership of the Supreme Kleagle, an army of forty thousand swept like bats out of hell through Florida, Georgia and South Carolina, demolishing every radio station, professional or amateur. Hooded figures in billowing gowns, fronted with the sign of the knobbed X, outpaced sweating detachments of United States cavalry, landed a shattering side kick on the nearest transmitter and vanished like wraiths into the safe sanctuary of agricultural areas.

Newspapers noted a sudden resuscitation of the ancient Molly Maguires in

the mid-West. Perspiring farmers, masked, wearing Irish bonnets obtained from heaven alone knows where, passed their jackknives through copper wires, used tubes as targets for their shotguns. Official Washington ran round in circles when eight special investigators got back their pants by parcel post, collect.

As antiradio sentiment gathered strength, every nation ran true to form in the manner of its reaction. Sturdy independents of Ireland and Spain emulated America, took the law into their own hands and pushed over transmitters with enthusiasm permitting no argument.

The British Government ignored a petition signed by seven million suffering taxpayers, who "humbly prayed" that it "might please" the government to curtail the activity of radio. Neither did the British Government worry itself unduly when a deputation from the Federation of Radio Receiver Manufacturers said that the radio industry would cease to exist within three months unless something was done to induce people to buy their products.

Bankers remembered they had very large sums invested in the radio, agriculture and foodstuffs industries. It was foolish to permit one interest to strangle another. A deputation of financial bigwigs waited upon the stubborn ones at Westminster, and pointed out that though Britannia may rule a few odd waves here and there, "Old Man Gold" bosses everything else. Responsible politicians saw the point without difficulty; they were not going to be bulldozed by a moronic electorate, but were quite prepared to accede to the just demands of sound and sane finance.

The *Voice Of Albion* closed down forthwith; sixteen lesser stations closed with it; the remaining eight had their power reduced by half. Twelve thousand amateurs came under a ban, prohibiting their transmitters using power in excess of one hundred watts.

OCTOBER ARRIVED, and with it news from the United States that plant life was reviving and winter citrous crops showing signs of coming up to normal. That settled the few doubters still left. By governmental decree Soviet Russia reduced its radio power to one tenth that of yore. A grand total of fifty-two transmitters in Japan and Germany went up like sparked gasometers, when drilled and uniformed antiradio organizations in both countries struck simultaneously. Every nation in the world had taken, or was about to take, action to wipe out the airy menace—some voluntarily, some under the threat of violence.

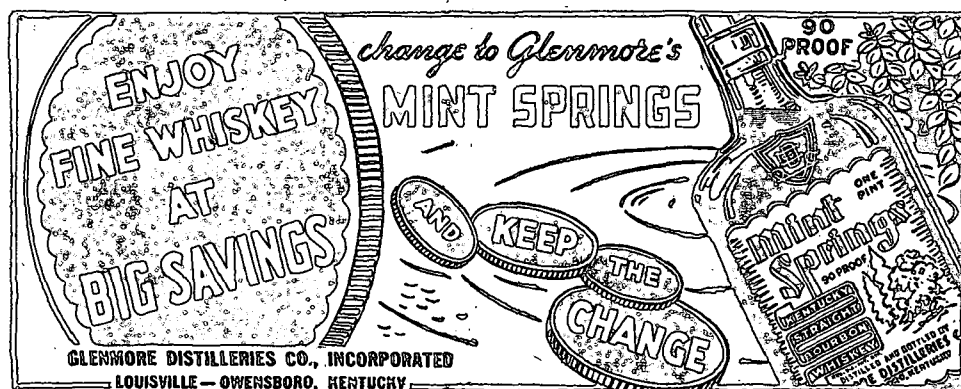
Spring of '60 saw a world born anew. Stunted plants again commenced to climb skyward, prematurely aged trees took on fresh youth. Every religion and denomination thereof *knew* that its own prayers alone had been answered, and offered more prayers of gratitude. Decimated flocks of birds settled and built nests with reasonable hope of rearing the families to come. City sparrows felt the influence of prosperity just around the corner, perched in the roof gutters, fluffed their tummies and nagg'd at lean cats below.

The year crawled along. All creatures waxed fat upon the earth and the full-

ness thereof. Blakoe and the editor of the *Daily Searchlight* were soon forgotten by a stomach-filled world. The Hop Sing Tong opened many new branches outside the Land of the Lotus; the half-hearted remnants of the Ku Klux Klan turned their attention to plowing.

News of the day revealed a world buried in its characteristically peaceful slumbers. Fourteen gangsters in the United States were plugged in one week; a South American republic had its regular Saturday afternoon revolution; the dictator of another celebrated his fatherhood for the seventy-second time. Britain blessed and launched an unsinkable battleship; Germany launched, without blessing, a submarine powerful enough to sink it. Another French Cabinet was formed to save the franc; Japan demanded an abject apology from China, or what was left of it; a Soviet scientist dumfounded biological circles by successfully crossing a dog with a goat.

An obscure author tore up his thirtieth rejection, started afresh and wrote a story telling how Martians resembling pink spiders wiped out the world with a giant transmitter directing its beam through interplanetary space. The story was kicked out—without regrets. The world had had quite enough of radio.



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The Endless Chain

*He was developing a device which would
reduce protoplasm to its elements—
as another had done—five hundred
thousand years before—*

A BRILLIANT SUN was rising over the somber Asian hills in the Far East, but Avalon was still wrapped in the mystery of the mists, which, during the night, had drifted into the city from the vast lake which made the great plateau the garden of earth. As the sun rose, the mists which flowed in the streets became white fire, an effulgent floor pierced by the splendid towers and spires and minarets of the alien buildings of stained marble and clear quartz.

Avalon—a city sparkling like a jewel in sunlight, built anciently on the edge of an inland sea of sapphire; a city so advanced and complex that our cities are immature huddles of stone and steel in comparison. For mankind, Avalon is yet to come.

In the center of this city of flashing light and sparkling, harmonious color a mighty building rose high above all others. The city was arranged around it.

Utterly invisible from the streets in the gulf below, Jay Lomas stood behind a parapet on one of those landing places and watched the last mists leave the city's lesser buildings. Except for a greater complexity of cranial structure, Jay Lomas was not greatly dissimilar to present man, although he was the product of a vastly longer evolution. From the standpoint of true civilization, his race was not old, although he would have expressed its length in terms meaningless to present men.

For men did not know of the Christian Era. Our present civilization had never been.

It was the invariable custom of Lomas to stand thus and watch the dawn come up over the hills; before entering the great laboratories to begin the short day's work. He liked to orient himself with the rest of the universe; it gave his researches purpose. But to-day, as if a curtain had vanished away from the truth, he perceived what he had never realized before; he was utterly out of step with the universe, and he had never been in harmony at all.

He turned away from the glittering city and the great lake of sapphire. An elevator, unattended, swept him down to the twentieth floor, where his own laboratories were. He walked slowly along a corridor filled with hurrying scientists like himself, and deliberately fell in with a tall man whose thin, mobile lips and bright black eyes betrayed a perpetual sardonic humor.

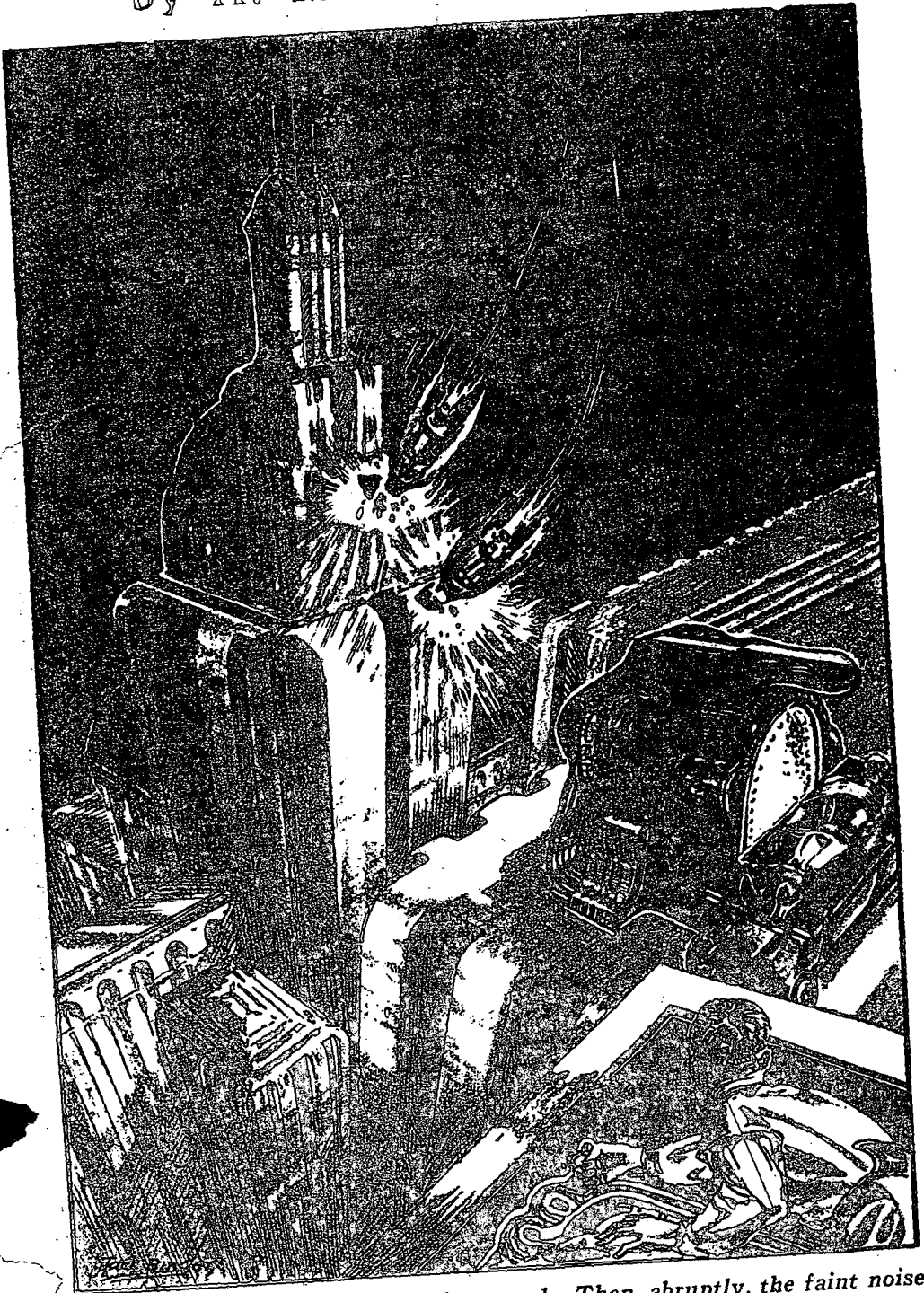
"Lane," Lomas said huskily, "I have just seen that all my work is utterly irrational and illogical, against all principles of life and evolution. For years I have been blind. What am I going to do?"

Lane's lips parted in a smile of faint irony. "For some time," he answered, "I have been aware that one of us was mad. But recently I saw that we were both mad."

"You mean——"

"What you mean. Your life, my

by A. MACFAYDEN, Jr.



For a flickering instant nothing happened. Then, abruptly, the faint noise of the city died into a quick hush; two air machines fell into steep curves—

dear Lomas, has been unintentionally devoted to destruction. Six months ago the council commissioned you to develop a weapon for the coming war with Himelya, and you reported yesterday that success is certain. You are on the verge of generating electromagnetic radiation capable of disintegrating human protoplasm into its constituent elements.

"And I!" Lane laughed. "I have it completely within my power to build up living protoplasm from elements. The construction of living organisms—even men—is almost within my grasp. In weeks I shall be able to do it. In weeks you will be able to undo it. And all for what? For nothing."

"We of science," Lomas whispered, "are committing suicide. We do not know what weapons Himelya is assembling; certainly their brains are equal to our own. My weapon is irresistible. I am almost sure that theirs will be, also. What then? As our fleets sweep out of the sky down on Himelya, theirs will descend upon Avalon. As their nation vanishes utterly in my fields, we in this city will die, also. Science will be no more. It is madness, Lane."

Coming to a branch in the corridor, they stopped, and their eyes met. Lomas was pale; Lane had a faint smile on his thin features. Each waited for a word from the other. Each knew that only a word was necessary, to start a mutual revolt against the wishes of the council.

But neither gave it. Gradually, the fire died in the eyes of Lomas and the expectancy left those of Lane. Without speaking more, each took a different branch along the corridor, never to meet again.

THE THRILL of research soon rendered all Lomas' doubts impotent. He quickly formed the mental defense that he was compelled to perform the will of the council, or suffer the fate of a traitor.

Weeks later he stood in the bright sunshine on the landing roof and watched his assistants make the final adjustments to a strange, enormous device brought there for testing. He was uncertain of its range, and his own laboratory was too close to the work-rooms of others. In theory, its range was infinite, and its frequency was of the order of magnitude of that used for communication, so that there would be a ground wave and an atmospheric wave, refracted by the ionosphere.

The heart of the apparatus was a cluster of tiny, evacuated tubes, each smaller than a thumb, which modulated the waves produced by standard oscillators. The frequency was almost unimportant; the wave form was everything.

Since chemical bonding is essentially an electrical phenomenon, it was natural that elements which combined to form protoplasm could be disrupted by electrical means. But the exact wave form had been discovered only after long weeks of work. To break up even a single human body would take considerable power, but Lomas fed his device with the energy of disintegrating atoms.

For the experiment the council had provided a man so hopelessly insane that his death had been decided upon in any event. Lomas watched them bring the creature—a strange and baffling case, he thought—out of the elevator, on his wheeled table, to the apparatus. His straps were inspected, and then the seven assistants turned to Lomas. Lomas was wondering, for the first time, about the ethics of using for a lethal experiment a subject not responsible for his condition.

But the same apathy which had numbed his will weeks before threw its influence upon him again, and he closed his mind to such thoughts.

"You have done splendidly," said Lomas to his assistants. "I know that we shall succeed, and doubt that there is

any danger, now. But the final risk must be mine. Please leave the roof."

They went without protest, but unwillingly, and when the roof was clear of all except himself and the incoherently muttering subject, Lomas walked fifty feet to the near parapet, where remote controls had been set up.

He glanced once over the low wall, at the glittering city of buildings hewn from titanic hollow jewels, of diamond, ruby, and sapphire; at the colorful dots far below the science building, which were people moving on the wide ways; at the dipping and rising air machines.

Then he carefully manipulated the controls. Fifty feet away the generators hummed loudly, and the subject twisted in his straps. Two air machines threw moving shadows across the roof. Lomas closed a switch.

For a flickering instant nothing happened. The subject did not flash into gas and steam. Then, abruptly, the faint noise of the city died into a quick hush, enduring for a heartbeat like a deadly influence. Then regular noises came, like crashing footsteps walking in the city. Two air machines fell into steep curves, and smashed down on the roof, where they lay motionless. As Lomas stood puzzled, the regular crashes died away, and silence fell again, broken only by the loud humming of the generators. There was a single, last crash, coming from a distance.

After that, silence, and the muttering of the lunatic.

QUICK INTUITION laid horror on the brain of Lomas. He shut off the generators and leaned over the parapet. He gripped the metal rail, and a single, wild cry escaped him.

The spires and towers of colored Avalon still glittered in the sunlight, and a faint breeze broke up the surface of the distant lake. But Avalon was empty. Silence, like a vast sea, was everywhere in the streets, and that sea

had drowned and absorbed all life. The colorful figures were gone. Wrecked and broken air machines lay at intervals along the wide ways, scattered here and there in the great squares. From his height they were small things. He strained his eyes, stared into the distances, seeking for some movement. There was nothing.

Lomas turned and began to run across the roof to the other side, panic-stricken. He slowed as he passed one of the fallen air machines and looked inside. It was quite empty. He opened a door and a gust of gas and water vapor burst out into his face.

He reached the other side and his head twisted and turned as he examined the city as far as he could see. From the great height of the science building he had a clear view to the city's outskirts, and part of the country, obscured by yellow haze. Nothing lived anywhere.

Then he saw a distant speck come flying in across the city from the lake, black against the dappled sapphire. It expanded. But it was not an air machine; it was an enormous bird, of a type which seldom ventured within the city. It flew closer and soared above the science building on great, slowly flapping, black pinions.

Lomas stared up at it. The creature emitted a single, sardonic cry, which echoed as a faint croak in the canyons of the dead city, then flapped its slow way into the west.

Lomas stared down at the lower spires, with his brain numbed by horror and desolation. In a second he would have thrown himself from the height, losing himself in oblivion, where the knowledge that he had slain Avalon would not torture him. But indecision again turned his resolution to water, and he went slowly back to the generators.

The lunatic, in one of his almost rational intervals, muttered, with his eyes

on Jay Lomas: "Gone south in darkness and north in spring. Graves and all bright things in the eternal sea. Gone south——"

Lomas smashed his clenched fist into the face of the lunatic, and the muttering stopped. Lomas sank to the roof and hid his face in his hands.

HOW LONG he remained like that he never knew, but when he rose the sun was near the zenith and the lunatic was muttering again.

Ignoring the madman, Lomas stepped into an elevator and dropped to the first floor. He searched the laboratories. In one almost immediately below the generator he found a neatly severed trunk. Otherwise, there was nothing. He swept down past floor after floor, slowly, so that no faint noise might escape his ears. Then he returned to the roof.

Lomas stepped slowly out of the elevator, and tramped dully across to the generators. Existence was now almost completely without meaning, for all he had known was gone; his race was extinct, but for himself and a lunatic. He thought: "Avalon, Avalon is dead."

He wished that he had gone with the others, and wondered dully about the cause of the strange zone, where the effect had not existed, which had saved him alone. Doubtless it was due to some form of skip distance, although uncommonly restricted. More probably, interference had nullified the effect in a small area about the generators. It did not matter.

The lunatic muttered: "Darkness in the caverns of the blue sea, and fish with human heads." His eyes rolled up. "The current stirs their hair. They sleep in the north, in darkness."

Lomas bent over the man, wiped the blood away from his mouth. He was not quite sane himself and already he regretted striking the lunatic, his last fellow man; for Avalon was a city state,

and if Avalon was dead, then the race was dead.

He stared deep into the shifting, unseeing eyes. He longed for a companion, to share his misery and horror. This had been a strange case, the first incurable psychopath ever known to the physicians of Avalon. It was as if the man had utterly lost all contact with reality, as if his body dwelt in this world and his brain in another.

Lomas said, sharply, "Are you mad? Are you sane?"

The lunatic answered, "They sit and sit and never move. They sit secure in coral grove. Darkness in the dim caverns of the misty city."

At this nonsense some curious impulse drew the head of Lomas lower, until his face almost touched that of the lunatic. Their eyes met and clung, but with a tremendous effort of his failing will, Lomas pulled himself upright. In another second he would have been mad also. His terrible depression had narrowed the gap.

He turned away abruptly, leaving the madman muttering his incomprehensibilities, and crossed the roof to his own air car. Perhaps some ring of Avalon yet remained; members of the city often wandered far into the country, although he did not then know of any absent. Perhaps they had escaped.

He swept low over the city, inspected its spreading reaches intensively. But nothing lived in the silence. He searched the surrounding country in widening circles. Birds circled unharmed, and he saw strange beasts moving in the meadows, undisturbed by the silent air car. They remained, but of the fair dwellers of Avalon—nothing.

He closed the windows of the narrow, graceful ship, and flew south beneath the full white light of the brilliant sun. Himelya, that strange city of squat buildings hidden in a mountain valley, was beyond the southwestern horizon, and Avalon had long had scouts watch-

ing the city, because of the coming war. He would talk with them.

THE EARTH blurred into a quick, rushing brown-and-green expanse, streaked with the quick steel glint of rivers and the longer flash of lakes. Himelya was almost twelve hundred miles distant, and he increased his acceleration to the point where he almost lost consciousness, attempting to submerge the thought that he had murdered Avalon in the struggle to keep his senses.

The green fertility and junglelike profusion of the country around Avalon, Shamoh, quickly changed to the sparser vegetation of the great plateau which stretched between Shamoh and the mountains of the territory of Himelya. It was a high plateau—for its height the highest on earth—crossed with great mountains, and blue salt lakes. It was a strange and barren place; when the rest of the earth was vastly fertile, and it was inhabited by an alien race, who lived in isolation. It was said that they were not true men, as were the dwellers in Avalon and Himelya, but they discouraged investigation, and possessed powers baffling even to the minds of Avalon.

Lomas closed his eyes. He must stop thinking about Avalon.

He was flying at a constant altitude of a thousand feet. The peculiar towers of the cities of the plateau whirled past beneath, and shortly the great dark masses of the mountain range forming the southern border of the plateau began to loom up over the edge of the world, and he slowed his great speed, since the ships of Avalon were destroyed by Himelya on sight.

He rose up over the foothills of earth's most terrible mountains, and stared down at the somber gashes and the great peaks. Once the peaks had been shrouded in eternal snow and ice, and the valleys filled with slowly mov-

ing, perpetual glaciers, but earth's climate had changed since those distant epochs, and now lichens grew on the highest summits. Himelya was somewhere in the west, and it was time to consider the probable location of the scouts of Avalon.

Lomas did not know where they would be, for that had been a council secret, but he was familiar with the general strategy. Day and night Himelya was watched by ships poised high in the stratosphere, undetectable and invisible. Off duty, the ships would be hidden in caverns, behind hundreds of feet of rock; but he would have to search for the caverns.

After three hours of silent circling about hidden Himelya, he found a round vent in the face of a towering mountain shoulder, and sent the car into its dark depths. He passed several bends in the tunnel; then lights appeared in the darkness ahead. He entered a great cavern, where ships lay in regular rows. Five incandescent spheres, like tiny suns, wheeled silently in complicated orbits near the vast, arching roof.

Lomas dropped the ship lower, to the smooth floor, and stepped out; he was troubled by a faint apprehension. He stood for a moment beside his air car and stared about. The same sea of stillness which had invaded the streets of Avalon spread its hushed influence in this cavern. At the implication, Lomas felt terror and deep sadness.

He ran over to the ships, even smaller craft than his own, and began throwing doors open in a quick panic. Had his devilish device reached here, too? As each door swung open a volume of heavy gas, with various odors inextricably mingled, puffed out into his horrified face; and on each cabin floor there was water in tiny pools.

There were a dozen ships; he searched every one. At the end, he uttered a great cry of despair and revulsion; the thin sound swelled up into the heights

of the cavern, and some trick of acoustics set it booming mockingly among the spinning suns.

He entered his car and fled from that cavern of death, leaving the suns to pace their slow orbits down eternity, and came out into bright sunlight. He lifted above the Titanic folds of the mountains and soared a tilted way into the blue sky, up and up, until the mountains became like plowed furrows beneath him. In the hollow of one of the furrows he saw the green spot of the city state of Himelya. For it, he arrowed in a long, flat dive, not caring, now, whether he was fired upon or not; he suspected that he was in little danger.

MOUNTAINS flickered past beneath the car, and the green valley expanded. Great forests of strange conifers fringed it, and clear rivers flowed from the mountains across the fertile plains, meeting near the center. At the confluence, the squat, round towers of Himelya rose black against the green of the fields. The city swung near, and moved beneath him.

Himelya, too.

Sunlight threw long shadows across the streets, and shattered air machines lay in the wide ways, and on the roofs of the city. But nothing moved in the streets, and the great, wide towers stood silent. Nowhere in the city was there anything of life. The alien, squat and hairy men of Himelya, who had threatened the power of Avalon, were gone.

With despair again closing its dull grasp upon his brain, but without much regret, since Himelya had been an enemy, Jay Lomas turned his craft to the south again, and fled over the mountains to the plains beyond.

Lomas flew to the ocean, where there were still cities. After half an hour he flew low over them, but they, too, were dead.

He lifted the car up into the strato-

sphere, and flew quickly to the other side of the world, to the heart of the northern part of a continent almost as large as the mighty land he had left. There were no cities here, and little civilization. But there were the barbarians, strange, primitive, tall men, who used crude weapons and slew great beasts. Once, their legends ran, they had been a great race, whose towering cities equaled the glory of Avalon and Himelya. If they were gone, then man was gone from the earth.

He saw the great ocean, which divided the two continents, slip past beneath, and started his long descent. An hour later he was flying low over the wooded plains, searching. Another hour, and he was returning to dead Avalon, with the knowledge that of the human race only he and a lunatic were left.

On the way back he wept a great deal, and then sang. Often, staring down at the world, and realizing that on all earth he was the only sane man, he laughed for minutes at a time, for he had begun to suspect that he would not be sane for long.

II.

AND SO he came back to the towers and spires of Avalon, reddened in the sunset's bright, furnace glow; the distant lake was a dark and gloomy mass, only half visible. The lunatic was still muttering on the roof. Lomas bent over him.

"Listen to me!" he said sharply, but the eyes of the madman would not focus on him. "Of all the world of men, only you and I are left. Do you understand? We are the last men. A lunatic and a scientist to live in Avalon! How can we carry on the race? Eh?"

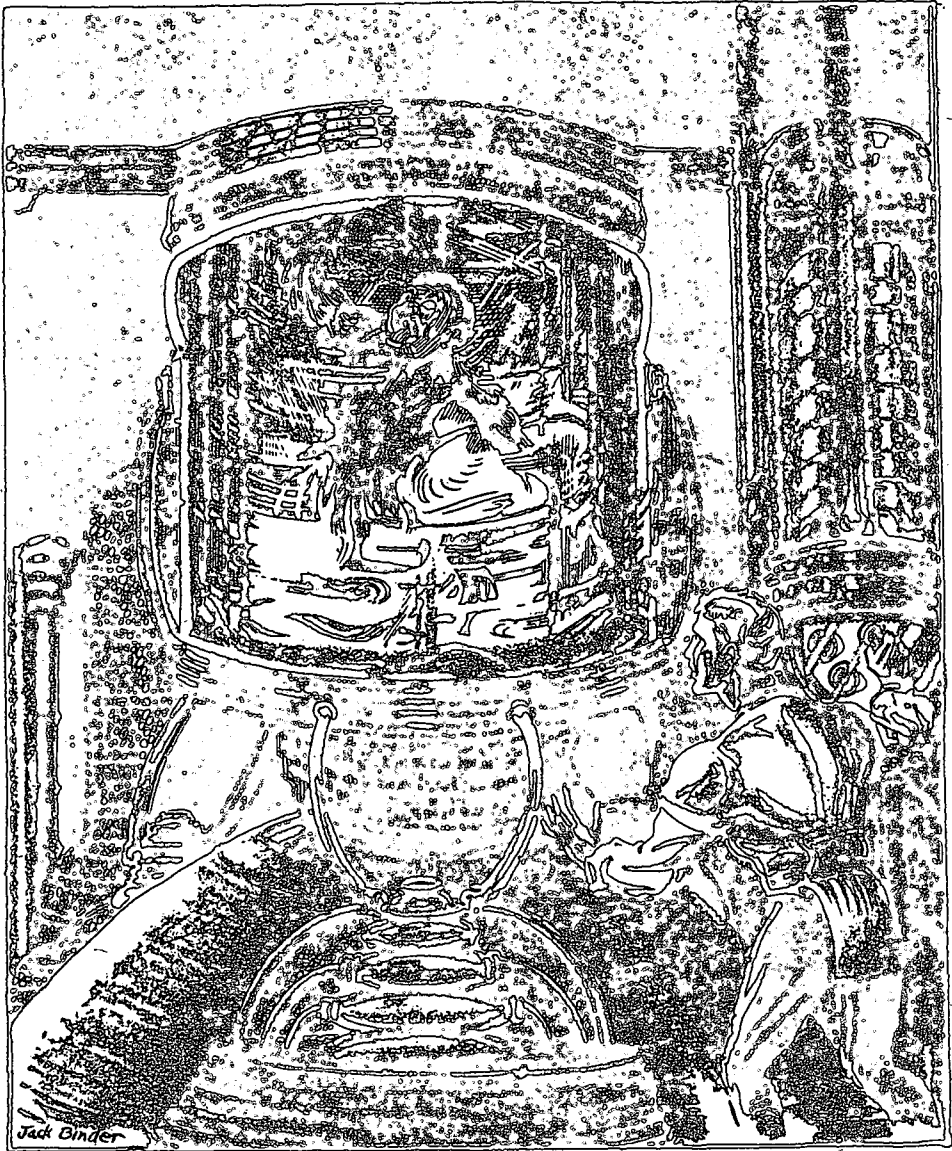
The lunatic answered, "They come from the wild hills in the long distance. He heard them, silent in the old tower, as he drew shadows from the moon on the grass. He talked with them, and saw the wild hills. He spoke with them,

and returned to the old tower, moving to and fro, to and fro, above the abyss."

Lomas grinned down into the face of the man on the table. The lunatic's face was dim in the dusk. "You're mad. Do you hear me? You're mad. And you're a man. How can a scientist and a madman start a new race? Eh?"

Lomas began to laugh. He laughed for minutes, until the tears ran down his face, and the silence of the darkened city forced its way into his laughter. He stopped, afraid, and some sanity returned to him. He went to the parapet and stared down into the city.

As he watched, the photo-electric



His first attempt developed into a misshapen monstrosity which almost filled the vat.

controls switched on all the lights, and the city became as bright as in the day. Decorative fountains of colored fire began to spray up into the night from the highest spires of the city, and parts of the distant lake began to glisten and shimmer under changing colors from the lights which flooded it.

As Avalon became more than ever a faerie city, sadness closed about Lomas, cleansing his mind of madness, and he saw with a bitter clearness the enormity of his act. Dully, he went back across the roof and wheeled away the lunatic, who kept up a rapid, pseudosane discourse about a world visible only to himself. In the psychopathic ward, a dozen floors beneath the roof, Lomas fed him intravenously, for the madman could not feed himself.

He cared for the second-last man in the world with a sardonic solicitousness, then prepared some food for himself. He ate slowly, but without tasting the food. Finally, he unstrapped the lunatic, put him unresponsively to bed, and locked the door of the white ward on him. Then he went to bed. He thought he would not sleep, but unconsciousness came almost instantly.

HE WAS GLAD to awaken in the morning, for had he experienced the dreams which had infested his sleep for much longer, he would have begun to think that they were reality. Once, in the night, he had seemed to be poised above a black lake; strange shapes were gathering fast among the dark reeds and the swirling shadows of the current. He shuddered, and went up on the roof.

But for the first time in many years he failed to watch Avalon appear from her shroud of mists, for he had risen too late. In the sun of early morning, Avalon was quiet and calm—and empty. He returned to the hospital ward and breakfasted. Then he fed his companion.

After that he went down into the

city and began an intensive search for life. He entered building after building, and was whirled through every corner of their interiors by the quick elevators or the moving ribbons of the corridors. Spinning silently along, he listened intently for any noise, and investigated every faint whisper. He worked in a widening circle and finally arrived at the border of the city. He stared out across the blue lake. The city was indubitably dead.

He walked slowly through the empty streets to the science building. Avalon towered about him. An elevator whirled him up more than a thousand feet, to the ward where he had left the lunatic.

Lomas stared at the man on the bed—lying with limp muscles—for a while, then he searched for the lunatic's case record. The man's name was Soan, and little was known about his history. A month since, he had wandered into the city from an unknown direction; he had been found walking and talking near the lake. Citizens had informed the council, and Soan had been brought to the science building. Yet he seemed to be of Avalon.

Lomas stared at the lunatic; he could change the sex of Soan without much difficulty. Although his own field was inorganic chemistry, he knew a little biology, and the changing of sex was a very elementary technique; he was familiar with it. But the prospect of fair Avalon overrun by a mad race who muttered incomprehensibilities and could not feed themselves revolted him.

He bent over the recumbent, muttering man, and said, "Shall I make you sane? Shall I make you sane, and a woman? Progress demands it, my friend. What is your opinion?"

The lunatic answered, "Gone south in darkness, but a light in the abyss. It is a terrible thing; darkness and the dim hills and the bent branches in the long wind—"

Lomas sighed and found a notebook;

his first task was to bring sanity to that deranged brain. He began to take notes; he would try to draw some semblance of reason from the insane mutterings. He sat for four hours, filling his notebook with neat shorthand, and during that time Soan's words never ceased.

After five hours of study he had made little progress, and his brain was weary. Psychology was highly specialized, now, and it was not his subject. His table was littered with reference books. He rose gloomily and went up to the roof. Dusk was throwing its long shadows again over Avalon.

He stared down on the dead city for a while, observing that the great black birds were becoming increasingly frequent; soon Avalon would be the nesting place for birds, and the shelter for the beasts.

He went to bed, tortured by dreams.

AFTER THREE DAYS of intensive study of the lunatic's inscrutable and enigmatic mutterings, he saw no faintest light; he had attempted to reduce his discourses to variations of a single, central theme, an analysis of which would indicate how a cure could be effected. But it was hopeless.

And so he considered the problem from another viewpoint. The cause of Soan's madness could take only two forms. Either his derangement was the result of objective forces, or of subjective. In the last instance, Soan's madness was due to inner maladjustments. In the first it was due to some occurrence or event taking place *outside*.

The possibility of a head injury resulting from a fall, Lomas rejected; for the physicians had considered accident possibilities. And of all other possibilities, this was the most probable: *That men had made Soan mad.*

Then, what men? Not the men of Avalon, certainly. And he could think of no reason why Himelya should do

this, for a certain type of psychology was indicated.

He spent another hour in study, concentrating on the oral methods of examining a subject. This was highly advanced; the physicians of Avalon often effected remarkable cures by simply conversing with the patient. He finally composed a series of questions, the answers to which would indicate whether his hypothesis was correct.

Then he conducted the lunatic to the roof. The day was dull. Clouds had moved in from the lake, massing gloomily in every direction, and the colors of Avalon fought vainly against the somber sky. There was a wind, blowing gustily over the high roof, and the steel gray of the distant lake was broken up into white streaks.

Lomas drew Soan, muttering dreamily, to the southern parapet, and made him face that great plateau which divided the land round Avalon from the mountains near Himelya. He drew a deep breath, and put his question, gazing deep into the eyes of the madman, "Why were you driven from Lengoh?"

As he spoke the name of the strange plateau, he was astounded to observe the awful change which came over the face and body of Soan. The features darkened and changed beyond recognition; the shoulders swelled and the hands became hooks. As the dreadful metamorphosis continued, a new light entered the changed eyes, and the hands reached out to Lomas.

Horror swept him. He remembered rumors about the plateau, tales of men whose forms were not fixed. Before the change could proceed to its climax, he stepped forward desperately, and brought his right fist up to the face of the other, in a flat, jolting blow.

The low parapet met the staggering body of Soan below the hips. Lomas struck again, with both hands, and the creature, no longer a man, dropped backward into a sudden emptiness, ut-

tering a single cry which froze the blood of Lomas. Panting, he leaned over the parapet, and watched the body shrink as it fell more than fifteen hundred feet. It fell for eight seconds, then he saw it strike the distant street. A second and a half later he heard the faint thud.

III.

NOW, he was the only man in the world.

Soan had not been a man of Avalon, he thought dully. He had been a stranger from the plateau, in the form of a true man. The transformation had not been complete; the body, unstable, had returned to its old form when suitably excited. He had been made mad, and driven from the plateau. But it did not matter.

Avalon, then, seemed forever dead.

He had not even the lunatic to talk to.

The hope which had sustained him in the past five days crumbled; and melancholia threw its numbing wings upon his brain. Dully, he stared down at the distant body, crumpled shapelessly on the yellow street. To think of making *that* sane, and a woman—

He descended slowly to the beds of the hospital, and for three days left them only to eat; he was sunk in a brooding inertia, and assailed by a tremendous loneliness.

Toward noon of the fourth day a new thought burst like a spark in his brain, and he wondered how he could have overlooked it. Lane's experiments! While he had been working to destroy protoplasm, Lane had been trying to build up living organisms. What if he had succeeded, and had been on the verge of creating—man? Hope, like an inner light, flushed Lomas' face, animated his eyes. He was instantly a scientist again, and a new man.

He ran out of the hospital, leaped into an elevator, and hurried along corridors to Lane's old biological labora-

tory. He knew as much about the chemistry of protoplasm as Lane had known; he would only need to study the living properties of protoplasm—metabolism, growth, cell reproduction, rhythmicity, irritability, conductivity, and adaptability. Eagerly, he burst into the laboratory and looked about, expectantly.

But it was a very ordinary laboratory. The only noteworthy piece of apparatus was a squat, quartz cylinder in the middle of the floor. Taller than a man, it was fully ten feet in diameter, and its smooth walls were studded with innumerable electrodes, from which connections trailed to various devices arranged in a circle about it. There was a round door in the flat top, and as Lomas approached, he saw that the cylinder was almost filled with a clear, viscous liquid, which refracted the light.

He mounted a small ladder and unsealed the top door, swinging it back. When a warm gust of strangely odorous gas belched up, he knew there had been something living in that cylinder. Lane, then, had been at least partially successful. He climbed down and began a search for Lane's notebooks. He found four in his desk, and the fifth was open on a bench; a pen lay on it, and there was a huge blot—

HE SPENT the next two days in study. On the third—thirteen days after the death of Avalon—he thought he could make a few tentative experiments.

Protoplasm, the stuff of life, could be built up from inert matter without much difficulty, now; it was almost as easy to build up as to destroy, as he had done. Any chemist could do it, using synthetic fats derived from petroleum; starches and sugars made from carbon dioxide, potassium nitrate, and water, by ultra-violet irradiation. Proteins were more difficult, but they could be formed from amino acids, by dehydration.

But in the construction of an organism as complex as a man, the formation of the raw stuff was only the beginning. It was not possible, Lomas reflected, to construct man in sections, as one puts a clock together. The numberless functions of the finished body, and the bewildering structure of its parts, were beyond human ability to duplicate. The problem must be resolved to a simpler form.

There was but one solution, and it had been Lane's solution. All life, including man, can be reduced to the two cells which start the birth cycle; in the egg and the spermatozoon is the man, and the ultimate shape of what the man is to be; united, they form the zygote, and the zygote merely has to be fed; its development is already determined. He could produce the spermatozoon from his own body. If he could create the egg, with all its incalculable, character-determining genes, from inert matter he—

Avalon would live again.

He stared about him with glittering eyes, then began to study the last notebook intently. Lane had been working along those lines; it was, indeed, the only approach possible. But the difficulties of the technique appalled Lomas.

The raw stuff, the primal protoplasm, he could produce without difficulty. But the creation of artificial genes—those discrete packets of chemical molecules which predetermine every ultimate detail of the structure of the fully grown organism—seemed to be an undertaking of apparently insurmountable complexity. But Lane had done it, and he could learn. Even that was but the beginning.

For each gene still had to be arranged spatially with respect to every other gene, and the patterns had to be arranged in chains, each chain forming a separate chromosome. In the creation of man, forty-eight chromosomes would be involved, and many thousands of

genes. Lane had been on the track of perfect control, accurate placing of the genes. He had built several rudimentary organisms, to prove his ideas. But he had never attempted a man.

Lomas turned in his chair at Lane's desk, and stared for a long time at the quartz culture vat. There were certain dangers. There was the matter of a soul. He knew the secret of life—it was simple. He would merely charge the finished germ plasm—the egg—to a certain electrical potential; that would start the complex chain of chemical reactions called life. But the soul—

And there was a peculiar hiatus in the notebook. There was a single, queer reference to evolution. Its significance escaped him. But it had an insidious and disturbing influence on his thoughts, as he began the long study.

The days passed quickly. Every morning he watched the mists leave Avalon. The city stood lonely in the dawn, but it seemed as powerful and eternal as the world. He knew that it was not. Unless he filled it with life, the towers of Avalon would be gone in a hundred thousand years.

IT WAS six months before he knew as much as Lane had known. It was eight before he watched his first organism grow in the quartz vat, absorbing nutriment from the viscous solution, its growth stimulated by the complex currents which swirled in that solution, pouring in from the electrodes fused into the walls.

And it was a full year before he first tried to make a man. Before that tense attempt, he had made egg cells by the hundred, each with thousands of genes linked into chains of forty-eight chromosomes. With all the apparatus—most of which he had developed himself—he had practiced incessantly every stage of the technique. He believed that he could control the formation of the genes, from proteins, and their spatial arrangement.

He thought he could duplicate every detail of the actual human birth cycle.

But his first fertilized egg cell developed into a misshapen monstrosity which almost filled the vat, absorbing food greedily, growing at an incredible rate. He stood near the electrical controls, pale with horror. It was a pathological human being, almost unrecognizable, with certain hideously exaggerated aspects. It thrashed violently within the vat, until he feared that it would smash through the quartz with its inhuman strength. He killed it with an abnormal electric current.

For almost a day he did no work, until he had banished the dreadful memory from his brain, then he returned to the laboratory. He dissolved the thing, and drained it out of the vat, shuddering; he flushed out the vat with volume after volume of acid, lest any of the fearful taint remain.

Then he returned to the task. The first experiment had been almost human, so he was within sight of success. Perhaps but a few hundred genes had been incorrectly placed; a single altered gene may rob the human eye of all color. Week after week, he worked on.

During that time he created organism after organism, and each became increasingly human. Hope spread its invigorating touch upon him. It seemed only a matter of detail, as science had always believed.

AND THEN, one day almost a year and a half after the death of Avalon, he made his first sub-man.

For some time before this straining experience, he had been wondering again if he was quite sane. And when the strange, erect creature stared out at him through the quartz walls with almost blank eyes, his brain was assailed with the most extravagant images and sensations.

Completely immersed in the solution,

and so not requiring to breathe to live, it was still growing; it had been developing for five hours. He stared at it with a cold, scientific interest.

Its size did not differ from his own, and it stood erect, with human hands dangling from crooked arms. Its skull showed remarkable posterior development, and it was obvious to his experienced eyes that the brain, though far smaller than that of any man, was yet larger than that of any ape. He put its endocranial capacity at 950 cc., although he could not be sure.

It bore such a bewildering resemblance to specimens in one of Avalon's museums that he gave it the same name.

"Well, *Pithecanthropus*?" he said.*

The erect ape man! He studied the lips, and the undeniably human jaw; probably the man could speak; certainly he could use tools. Then disquiet swept him, for he had suddenly perceived that its growth had strangely stopped. What was this?

He studied his controls. The solution retained all its strength, and the several hundred currents were flowing steadily into the vat. Yet development had ceased. More, the eyes were glazing, and then a sudden mist hid the erect body, but not before he had seen that it was shrinking quickly. He shut off all power hastily.

The mist cleared, but at the bottom of the vat was only a tiny thing resembling a child, with the face of an ape. Puzzled, he drained it away, and repeated the experiment, with another fertilized egg.

The egg, growing with inconceivable speed, passed through all the stages which the body passes before birth. From a shapeless mass of embryo, it assumed the shape of a fish, passed through the amphibian and the reptile stages, then grew rapidly through sev-

* Lomas, of course, had never heard of Latin, but undoubtedly there was some exact equivalent for this term in his own language. A. M.



He thought, "My relatives will be glad to feed me——" Then he was down before a surge of stronger bodies—the last man on Earth was dead——

eral forms resembling various lower mammals.

Amazement suddenly swept him. He saw an event which at first he took for a simple error. Instead of passing from a semi-ape stage, with tail, into the recognizable form of the human child, and growing from that stage into the living man, the thing in the vat was develop-

ing from the half ape into the full anthropoid, and then into the sub-man.

It seemed to be more than an error. It was baffling. The thing had come from two cells, one undeniably human, and the other an almost perfect synthetic duplicate.

Why, then, should it develop into an ape, then into a sub-man? How could

it possibly deviate from the line of inevitable human development?

He read Lane's last notebook, while the sub-man in the vat grew rapidly. But Lane could not help, for he had never reached this stage. But he had suspected—something. There was that inscrutable reference to evolution. It still did not make sense.

He put down the notebook. From the apparatus which ringed the vat came a steady display of miniature lightning, corona loss and brush discharge. He looked at the vat. The same mist came again, a few minutes later, and vanished, leaving a tiny ape in the solution. For some reason it would not develop beyond *Pithecanthropus Erectus*.

Lomas sighed wearily. He had been working without a break for thirty hours, drawn on by the fascination of creation. He was suddenly exhausted, and stopped work. He slept.

IN THE MORNING, after an invigorating view of the morning mists, he built another sub-man. This time he cut off the current before the mist came. He drained off the solution and let in air. The sub-man in the vat instantly dropped to the floor in a heap.

Lomas muttered, "He doesn't know how to breathe." He hoisted the creature out with a small electric crane, and applied artificial respiration. When the eyes had opened, he leaped back to the bench and picked up a gun. He lifted it to his shoulder and waited carefully.

The sub-man got to his feet, stood erect, with his big head thrust forward. The eyes under the massively ridged brows glanced slowly about the room.

Lomas, eyes glowing, felt his heart leap. It was not yet a man, but there was intelligence here! But he did not lower the gun. He felt a wholly unreasonable affection for the creature.

"Welcome, *Pithecanthropus*!" he said.

"You may not be perfect, but there is hope for Avalon. Speak!"

The thing was, in a way, his son, but his scientific calm was unbroken by the horror which a present man might have felt.

At his voice, his companion moved his lips, experimentally, then uttered a series of unintelligible syllables. There was a questioning note to them.

"I have made you, my friend," replied Lomas, although he knew the other would not understand. "And you puzzle me. You are apparently a perfect reproduction of *Pithecanthropus*, who was my own forefather. You are about four hours old, but I wonder what instincts you have. You are the first of your line, and so should have none—but I wonder."

He thought for a few minutes, while his companion stood warily, watching him with keen, unblinking eyes. Then Lomas advanced. The sub-man backed away, sensing danger with a keen animal instinct.

Lomas urged him into the corridor, and finally managed to get him into an elevator. He slammed the door shut, and dropped the car to the street level, following in another, for he had no wish to be cooped up in a small space with a badly frightened sub-man.

His caution had been justified. *Pithecanthropus* was a shrinking heap on the floor of the elevator when he swung back the grille. With difficulty, Lomas urged his companion along the great entrance hall and out into the yellow streets of Avalon.

Sunshine poured down. The big nostrils of the sub-man twitched as he noted the messages the wind brought his keen senses. Then, without another look at his creator, he turned and set off, at a graceful trot, along the street, heading with determination and deliberateness for the open country.

Lomas laughed. But he was still puzzled, returning to the laboratory. How

had *Pithecanthropus* known that the country was his natural environment, that there was food there? He had come from human seed. The obvious conclusion was that all the instincts man has acquired down through the long years, from primate to sub-man to true man, have been retained in the germ plasm. In civilized man, then, they were present but dormant. It was a contribution to science, but it did not help Avalon.

What had caused this atavistic deviation from human development?

He began work again.

In the long weeks which followed he created more than two hundred duplicates of ancient *Pithecanthropus*. The numbers of male and female were almost equal, and without exception they fled to the country when given their freedom. He reflected sardonically that unless he was soon successful in creating a true man, the world would be overrun with this race of near humans, repeating prehistory.

The problem was utterly baffling; he could not even begin to define it. Up to a point, the normal human development was perfectly duplicated, then there was this abrupt tangential change into the anthropoid, evolving into the sub-man. Again and again he checked the location, number, and composition of the genes within the chromosomal chains of the gamete. Again and again, he was satisfied he had created a perfect duplicate of the human egg cell.

And the synthetic environment—the nutrient solution, and the stimulating electric currents—seemed to correspond completely with the human prenatal conditions.

IV.

MONTHS PASSED. Increasing hopelessness dulled his eyes and roughened the keen edge of his brain. He began to experience strange periods of forgetfulness, intervals of oblivion which intruded their disturbing shadows upon

his life, perhaps symbols of coming insanity, or of approaching death. He sensed and fought against this, but there was a life-old apathy within him; his will had always been softened by a lack of decision, a failing which had slain Avalon and all life on the earth.

These blind spots were strange. He would go to work in the laboratory, patiently rechecking for the enigmatic flaw. Perhaps he would make an entry in his notebook. Consciousness would next find him walking somewhere on the edge of the city, with no knowledge of how he had got there, and with the pen still held in his fingers. Nor would he know how long he had wandered.

He tried locking himself in, but this was useless.

A year passed. In this time he made many hundreds of sub-men, of varying degrees of humanity, and watched them all flee from Avalon. No faint glimmer of light, of understanding, came to him. The lethargic periods occurred with increasing frequency, until he feared they would merge into complete, living oblivion.

And then, one day almost three years after the death of Avalon, he found himself in the wilderness farther from the city than he had ever been before. He was weak with hunger.

In the far distance, dim and high in the shadows of dusk, the towers and spires of fair Avalon rose, more than ever a faërie city. He was west of the city, and the last rays of the dying sun touched a faint red radiance on the soaring heights of the science building. Then the glow faded, and Avalon was a city of dark towers against the pale of the night sky.

Lomas looked about him. He was indeed far from the city. He was too weak to reach it without food. Then, dim in the near south, he saw the flicker of a fire. He thought, sardonically, "My relatives will be glad to feed me," and trudged slowly toward it.

Perhaps he should have known better; but he was a chemist, and was not aware that in the old days all who were not members of the clan were enemies, to be slain on sight. They saw him long before he was close enough to be seen, and there was a quick rush in the dusk. He went down before a surge of stronger bodies, and was conscious of crude weapons of chipped stone in human hands.

Then there was a brief interval of sharp pain; it was not very bad. After that, blackness, like velvet curtains closing about his head.

The last man of the earth was dead.

V.

IN ANOTHER TIME and another space, a man walked across a great university's campus, in another city built near a tremendous lake. The city threw its towers about him into the sky. It was a very young city, and not beautiful, but it possessed a certain glory. It was early morning, in the spring of the year, and there was dew upon the ground.

John Keats, walking across the campus, looked about him at Chicago. It was Sunday, and there was no necessity for him to work, but he was going to work, nevertheless. At breakfast he had read an article about Roy Chapman Andrews in a Sunday paper, and his idle thoughts were about that article.

He whistled a song, the words of which he did not know, as he walked. It was something about, "We'll travel on—to Avalon." There was the Avalon in France, and one in mythology—the land of the Blessed in the Western Sea,

where Arthur was buried. Being mythology, it probably had never been near the sea, if it had ever existed. In the song, it had been thrown in for the rhyme.

He whistled another song, then hummed the first bars of the William Tell overture. He had nothing against the world this morning. Then his thoughts returned to the article.

This was 1929, A. D., and Roy Chapman Andrews had just discovered *Sinanthropus*, a sub-man a step above *Pithecanthropus*, yet exceedingly primitive, thirty miles from Peking. The sands of the Gobi, or Shamo, probably held some strange traces of prehistory.

It was strange, he thought, that they had been unable to go back further than *Pithecanthropus*, who was dated as living slightly before the Pleistocene, or in very early Pliocene, five hundred thousand years ago. It was easy to go back so far—from the true man Cro-Magnard, to the Rhodesian, Neanderthal, Heidelberg, Piltdown, *Sinanthropus*, and Java, or *Pithecanthropus*. Beyond *Pithecanthropus* the chain of prehistory did not go; there was a blank wall, although other mammals could be traced right back to their Eocene ancestors.

He began to think about his own work. Sometimes he wondered if it was quite ethical, and in the interests of humanity. But he shrugged and entered the chemistry building.

He mounted the stairs to his own laboratory, and all doubts were quickly forgotten; he was developing a device which would reduce protoplasm to its elements.

As another had done in Avalon, five hundred thousand years before.

NEXT MONTH:

THE SHINING ONE

By Nat Schachner



The Eye of Madness

*Colors—shades above
the violet—and
below the red—*

by
Ray
Rooney

*And then—before
me was a strange
caricature of a
man—*

BEING UNABLE to place the scrawled, shaky, yet vaguely familiar writing of the special-delivery letter, I turned at once to the signature: Gustav Tetzlund. The signa-

ture was genuine, yet how different from the usual clear, smooth writing of the famous surgeon. Puzzled, and a bit worried, I turned to the body of the letter.

There was no place, no date, only a few urgent lines:

EDMUND:

In Heaven's name come to my estate at once. I am in serious trouble; my sanity and life are in danger. I urge you to make all possible haste.

GUSTAV TETZLUND.

I knew my former instructor too well to doubt the urgency of his appeal. I pressed a button, began closing my desk. A uniformed nurse appeared in answer to my summons. "Miss Brownie, will you please call Dr. Herten to take charge of the office at once? His vacation address is on file."

"But, Dr. James, what of your appointments for—"

"They'll have to wait till Herten can get here. I may be gone for some time; if so, I'll communicate with him here."

The elevator dropped me quickly to the street. Hailing a taxi, I was soon at the garage where I kept my car. Hastily checking the gas and oil, I swung the car north. Once clear of the city traffic, I fell to pondering: "What could endanger Dr. Tetzlund at his secluded estate? Why had he wasted time on a letter, instead of telegraphing?" I gave it up, and drove faster.

IT WAS LATE in the afternoon when I reached the little village of Poncen, to roar along the main street in utter defiance of constables and speed laws. Dr. Tetzlund's place, to which he retired more often for rest these latter years, was a small, well-kept estate at the northern edge of the village. Not pausing to close the gate behind me, I raced along the winding drive, coming to a sliding stop at the door.

Judson, the only servant in the house, admitted me. "Thank Heaven you've come, Dr. James. He's been acting so queer since the operation. After he gave me that letter to mail to you yesterday afternoon, he went into his study

and locked the door. I haven't seen him come out, and it's so quiet in there. I'm afraid, Dr. James."

One word of his speech filled my mind. "Operation." I hadn't heard of it; and surely, if Dr. Tetzlund had been operated on, it would have been big news in the medical world. Something was wrong, very wrong.

I reached the study door, dismissing Judson, to his relief. After knocking several times and receiving no answer, I pressed my ear to the panel. There was no sound from within. Stepping back, I hurled my body against the door. Again, and the lock gave. The force of my rush carried me halfway across the room. And there I stood, as though nailed to the spot.

The study desk faced the door. Behind it, a comfortable armchair replaced the customary office type. Sprawled in the chair, his face to the ceiling, lay Dr. Tetzlund. I scarcely recognized the drawn, deeply lined features, the newly white hair. And that black patch over the left eye! A few months ago, just before he came here, he had not worn that patch. Judson's words came back to me: "The operation."

I shook myself into action, stepped around the desk. My professional manner came back, as I sought the pulse. It beat, faintly. "Judson," I shouted. He came running. "Help me to get him onto this couch. There. Now get my bag from my car."

As I waited, my gaze returned to the black patch. About to draw it aside, I hesitated, drew back my hand. "Perhaps, after all, I should await the doctor's permission. It might be a sensitive point with him."

Judson's arrival interrupted my thoughts. From the bag I produced a stethoscope, placed it against the doctor's chest. Weak, irregular heartbeats. The white hair, the lined face, and now skips in a heart that only a few months ago

had seemed to be perfect. What had he gone through?

Dismissing Judson, I administered a mild stimulant and drew up a chair to await results. Again I had to resist the impulse to peer beneath the black patch. A tinge of color appeared in the pallid cheeks; his right eye fluttered, opened, to look around with expectant fear, as one who awakes from a nightmare, dreading it may be true.

His glance rested on me, and slowly the fear left it. He essayed a smile. "Edmund. Thank Heaven you're here. I feel safer now." Speech was an effort. I must keep him quiet.

"Yes, you're all right now. But you must not talk; you need rest. Here, let me give you a narcotic. Then, when you are rested and stronger, we can talk things over." I tried to keep my voice calm, yet all the while I was eager to ask him about that black patch.

"No, Edmund, it would do no good in the end, only put things off a little longer. I have much to tell you, and only a little time before I go. Yes, I know. It's my heart. It's bad, Edmund, very bad, but I will live a short time yet, long enough to tell you a story, if only—— Edmund, don't remove that patch while I live. Don't let me move it, even if you prevent me by force."

Well, I'd have to wait, more curious than ever. No doubt his story would clear up the mystery. So I made him as comfortable as possible and placed my chair close enough so that I could grasp his hands if need be. With pencil and paper to note facts or symptoms that might be important, I prepared to listen to the strangest story I have ever heard:

"I came here last spring directly from my visit to you. It's rather isolated here, and quiet, just the place to finish a few experiments in optical surgery. I had almost perfected a new technique in the removal and replacement of in-

jured or diseased eyeballs. Working with dogs, I had made wonderful progress, but the constant interruptions of hospital work destroyed my powers of concentration on the final steps of the operation.

"So I retired to my little estate here. There is only Judson, and he does not disturb me, beyond an occasional insistence that I eat or sleep. I made rapid progress. Of course, most of the details had been worked out, and I needed only to acquire that final delicate touch that makes for success. A month of steady work gave the final polish, and three dogs on which I had operated were again able to see with eyes taken from other dogs.

"Think of the benefits to humanity, Edmund. When a person dies, some of the organs remain unchanged and uninjured for a short time. Of course, most people dread the thought of any mutilation, even after death, but there are many who would gladly give the bodies which they can no longer use to aid the living. I believe it has been done before, but my new method makes the replacement much more simple and certain, and will restore sight to many.

"For some time that night, when the success of my method was assured, I was unable to sleep. It was a warm spring night. From the little pond behind the house, hylas filled the air with their piping. I lighted my meerschaum and stepped outside for a turn about the grounds before retiring. From the little knoll near the barn I could overlook the village. It was two o'clock and not a soul stirred, not a light showed.

"A sudden hiss, apparently from above, interrupted my reverie. Even as I looked up, the ground shook slightly and a muffled thud came from the garden plot on the other side of the barn.

"I hastened there as best I could in the darkness. Earth was scattered

about in clods, and as I drew closer I could see a sort of crater in the middle of the garden plot. A dull-black mass was lying there, the top of it on a level with the ground. The thought of a meteor flashed through my mind.

"A glass of water, please, Edmund. Ah, that's better." His voice was stronger now, and no trace of terror shone in his one visible eye. "It was too dark to see much, so I went back inside the house for a powerful bull's-eye flashlight. It took me quite a few minutes to find it, and I was on the point of waking Judson when I ran across it.

"I hastened back to the crater, climbed the rim and flashed my light down into the pit. I expected to see a hot, rough mass of iron, a meteorite. And instead, there was a clearly artificial device lying in the shallow depression. It was shaped almost like a football, of brightly polished metal, and lay on its side. It evidently landed that way, instead of on one of the points, and the jar had thrown open a door in the side.

"Carefully, fearing it might be hot, I climbed down beside it. However, it was only warm, and I concluded that it had fallen freely only a short ways after getting out of control. Fearing that the men in it might be hurt, I tried to peer into the doorway, only to leap back, barely suppressing a cry of fear.

"It was nothing human, that arm that reached through the door, followed by a grotesque head. There was no neck; the cone-shaped head, slightly rounded at the top, blended into the shoulders. The mouth looked almost human, and great gasps came from it, as though he was choking from the lack of air. There were merely two slits instead of a nose. And the creature had but one eye, set near the top of its head. That eye was human in size, but a bright, fiery red. Just now it mirrored tremendous suffering.

"My experiences as a doctor and surgeon had accustomed me to strange

and terrible situations. I stepped forward to aid as best I might. Yet it was all I could do to force myself to grasp the arm that hung down toward me. With my aid, the creature managed to drag itself out the doorway and to the ground.

"It was a strange caricature of a man that stood beside me. It stood erect on two stumpy, heavily muscled legs that supported a cylindrical body. From the portion of the body that corresponded to the shoulders of a man, two long, well-muscled arms protruded. Both the arms and legs were jointed like those of a human being; the arms ended in hands with six long, flexible fingers. I could not see the toes. From its feet to the base of the head a garment that looked like sponge rubber fitted snugly. Only the head was bare; here the skin was a deep brown.

"But I quickly ended my inspection, for the creature needed help. Over the chest portion of its body there was a ragged rent in the rubberlike garment, and from the torn flesh that was visible a bluish fluid was slowly oozing. I started to lead it toward the house, then came to a halt, wondering if there were others, perhaps more seriously hurt, left in the space ship. For such I now knew it to be. But how to find out was a problem.

"The creature was intelligent, probably much more so than I. So after a few moments' thought I pointed to him and held up one finger, then to the ship and held up another finger. He seemed to grasp the idea at once, for he pointed to himself, held up one slender finger, then waved his arms to the horizon as though to say, 'I am the only one.' So once more I set out to lead him to the house. He seemed to sense that I meant him no harm and came willingly enough.

"We were soon in my operating room, with Judson bringing hot water. His face was a study in amazement and dis-

belief at sight of the stranger, but he made no comment and left the room when I dismissed him. A good man, Judson; he doesn't talk too much.

"I was in a rather difficult predicament. I knew nothing of my patient's anatomy, and I feared lest what I used as medicine might be poisonous to this being from another world. I was at a loss as to how to proceed, yet the bleeding was going on all the time, and he was breathing more heavily than the ordinary wound would account for. I decided to chance bathing the wound and started to remove the garment. As though he read my mind, the creature quickly laid bare the skin around the injured region.

"It was a nasty wound, but if the creature's anatomy had been like man's it would have been easily cared for. I succeeded in stopping the flow of blue fluid, but he was steadily failing, his breath coming with greater difficulty at each gasp, and I had little or no hope. I think he realized it, too, but he gave no sign of terror. How I wished we might talk to each other, that I might learn where he was from. The first known visitor from space, dying, and there I was, helpless in every way.

"An idea came to me. Picking up a pad and pencil, I sat down beside my patient and drew a diagram of the solar system. A gleam of understanding shone in his one eye, and, taking the pencil from my hand, he pointed to Jupiter. Then, handling the pencil adeptly, he drew a picture of Jupiter and marked a place close to what is known as the Red Spot. That, then, accounted for the mighty muscles of his arms and legs: they were needed to fight the tremendous gravity of the giant Jupiter, which, in turn, accounted for his difficulty in breathing in our rarefied air.

"He was sinking fast. I crossed the room for my bag and, by chance, threw the switch that set an ultra-violet-ray

generator into action. There was no sound from the apparatus, yet the visitor from space instantly turned to the source of what was, to me, invisible light. He blinked his single eye, then looked away. But the meaning of his action was not lost on me, and I resolved on another test. I had in the room an apparatus for producing infra-red rays and, unobserved by my visitor, I set it in action.

"Instantly, as before, he turned and stared toward the source of the rays. I turned off the device and adjusted it for a slightly longer wave length, then once more turned it on. And again he looked to the source. But now the motion was made with difficulty. He was going fast. I dropped the experiments and made a last attempt to save him. Yet there was nothing I could do; even as I reached his side he slumped down. A last flicker of friendliness shown in that red eye; he gasped, choked; then life was gone.

"Even as my visitor from space died, one thought was uppermost in my mind: his single eye was far superior to man's and he could see colors forever hidden from us. How different objects must look to one who could see ultra-violet and infra-red! Perhaps it was as great as the difference between color blindness and normal vision. It would be like entering a new world if a man could acquire such vision, a world all around us, yet invisible.

"Like a shock, the idea came to me. What if, with my new technique, I could use that eye to replace one of my own. An instinctive fear and horror warned me to forget the idea, yet I could not drive it away. The lure of new vision, of colors hidden from others, became stronger, and try as I would I could not reason it away. It gripped me; I had to think it over against my will.

"Sleep was forgotten; though it was growing light now and I had been up

all night. I examined the strange body; there was no sign of life that I could recognize. So, covering the body with a sheet, I relighted my pipe and threw myself into a chair to think over the startling idea.

"I thought of as many difficulties as possible in an attempt to deter myself from the mad course my thoughts were taking. I had imparted my technique to no one, so assistance with the operation was out of the question. But the human mind seems, somehow, eager to find a means to do forbidden things, and the idea of using mirrors came almost at once. A local anæsthetic would make it simple to overcome most of the pain. I tried to reason against it, but the lure of the unknown was too great, and in the end I lost.

"It was daylight by the time I gave in to the weird scheme. I was in need of sleep, but first there was much to be done. After every test I could devise had assured me that the creature was dead, I removed the bright-red eye from its socket, using extreme care. Careful measurements showed that its size checked with the average size of the human eyeball. There was nothing to stop me in my mad scheme. After placing the precious orb in a jar of preservative, I lay down on the divan for some sleep. My slumber was fitful, full of vague fears and horrors.

"On awakening, I disposed of a hasty meal. Then, with Judson's help, I buried the now rigid body in the garden. No doubt I lost much in the way of anatomical data, but my mind was entirely taken up with the course of action I had so rashly entered upon. I set up a number of mirrors and began practicing using my instruments, though, of course, doing no actual operating. Did you ever try working in a mirror? To say the least, it is confusing. But after several days of growing impatience, I mastered it. The day I looked forward to, yet dreaded, was at hand.

"I would rather pass over the operation itself. All the details are in a little black notebook on my desk, inclosed in an envelope addressed to you. Study and master it, Edmund, but use it for the good of mankind, not in folly, as I did. Though I could not entirely eliminate pain, the operation was at least endurable and at last completed. It would be a matter of two weeks before the nerve connections had healed properly, so I covered the eye with this black patch and waited as best I could. I told Judson that I had injured my eye slightly with acid, but a minor operation had set things right.

"I believed that the susceptibility to the longer and shorter wave lengths was due to a difference in the retina itself, and that the optic nerve would carry the impressions to the brain. As it turned out, my surmise was correct; would that I had been wrong! The days seemed to drag by. I could not study. I desired no visitors. I even avoided Judson as much as possible. But time must pass, and at last the day came when I could remove the bandage.

"With trembling hands, I drew the shades in my study, that a sudden glare might be avoided. I crossed to my desk and dropped into my chair, hope and dread alternating in my mind. I removed the patch and bandage, then turned to face the dim outline of the window. To avoid confusion, I had covered my right eye with the black patch.

"For a moment I could see nothing, but as the exposure continued, a dim patch of light appeared. As the brightness increased, there came a sense of irritation, a vibratory irritation such as some people feel when chalk grates on a blackboard. I could not call it light, yet I seemed to see it, a nameless shade mingled with the yellowish daylight. An unpleasant shade that bothered me, in a small way. But I dared not leave the eye uncovered too long the first day.

So I replaced the bandage and the black patch.

"Somehow, I could not seem to drive the thought of the new color, if I may so designate shades for which we have no name, from my mind. I was intrigued, as I then thought, by its newness, attracted, yet repelled by the memory of it. Even in sleep thoughts of it were in my mind.

"Early the next day I again removed the bandage, again covering my normal eye. My sight was a little stronger than before and the new colors, for so I must call them, affected my mind sooner. It was a dull day, so I left the shade up and looked out across the estate. All the regular shades were there: the greens and browns, the yellows and reds of flowers. And with them were other colors; I cannot describe them because man has never known anything like them and I have nothing to compare them to. Both ends of the spectrum merged into the nameless shades.

"Some of them had a horrible, depressing effect on my mind. I shuddered at the sense of ill-being they created; yet they fascinated me. You have seen colors that have a similar depressing effect: a room in which everything is gray will almost drive one to madness in time; bilious greens nauseate one; glaring yellows; reds incite passion; restful greens and blues. And some of these colors were even stronger in their effect.

"Mingled with them were shades of sheer beauty that kept me long after I knew that I should restore the bandage for the day. It was almost as though they hypnotized me; I could scarcely tear myself from seeing their exotic beauty. And all the while the evil shades were getting in their baleful, numbing influence. It was like a drug, enslaving the mind while wrecking it.

"During the day the urge to look at the colors again kept recurring. I

wanted to see them; yet I dreaded the thought. I drove away the idea as best I could by doing some work on my reports; even then it was a hard fight.

"When bedtime came, and I had nothing else to occupy my mind, the urge returned with increased force. I tossed and turned, but to no avail. Thought of those rare and beautiful shades would not let me rest, and all the time I was dreading the thought of seeing again the baleful colors. My thoughts recoiled from the memory of them as from some grotesque horror. Finally, I took a mild opiate that I might secure some much-needed rest.

"Again I removed the bandage. The eye was much stronger this time, the colors clearer and brighter. That meant, for one kind, more fascinating; for the other, more horrible, even loathsome. Imagine a garden filled with the most beautiful flowers, and creeping everywhere among them ugly, scaly monstrosities. No matter where I looked it was the same. I no longer noted the usual color of objects; all my attention was directed to the shades above the violet and below the red.

"So it went from day to day, becoming worse as the eye gained in strength. I no longer had the will power to cover it. On the fifth or sixth day I tried to bring myself to the point of removing it, but I couldn't. A drug addict, in moments of sanity, may throw away his drugs, but I had no such moments of relief. To operate, I must, of course, be able to see, and I must also expose the eye that was the source of my trouble. And each moment of exposure the colors were before me, more enchanting, more hideous and maddening. I could not destroy it; I must uncover it more and more as time passed. I resorted more frequently to drugs to obtain the rest I so badly needed. Now and then, when exhaustion drove me to a natural sleep, I would have frightful

dreams, alarming Judson with my screams of terror. For in my dreams the evil colors appeared to me as living horrors, come to prey on my mind.

"The increasing doses of drugs, the exhaustion, the mental strain of fighting the nameless fears the colors brought me, all combined to weaken my heart. My nerves are ruined; when I try to hold a scalpel my hands shake so that I have to give it up. In that month my hair has turned white; I have lost much weight. Realizing that the end is very near, I wrote to you, fearing that a telegram might expose my plight to others. It can't last much longer——"

I interrupted him, "You have talked enough; now you must rest." He nodded agreement and lay back, closed his one normal eye, and for a moment seemed about to sleep.

Then suddenly he sat upright. "My beautiful colors. I must see them, even if the others are there to torment me." He reached for the black patch, and, just in time, I seized his wrist. The struggle he made, in his condition, amazed me. It was only after several minutes that I had him quiet again. The

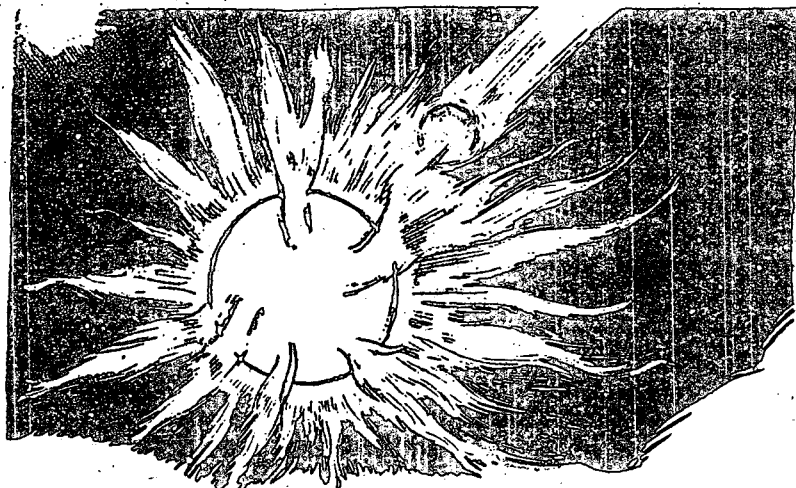
strain told on him terribly. Exhausted, he fell asleep.

I turned and started across the room to get the notebook from the desk. Suddenly a scream rang out, a scream filled with such pain and terror as I had never heard before, even in mental cases. Another scream started, ending suddenly in a choking sound. I reached his side, felt for his heart action. There was none.

Judson came rushing in. "He's having one of his spells again, sir. They're terrible, they are, sir. Is he all right?"

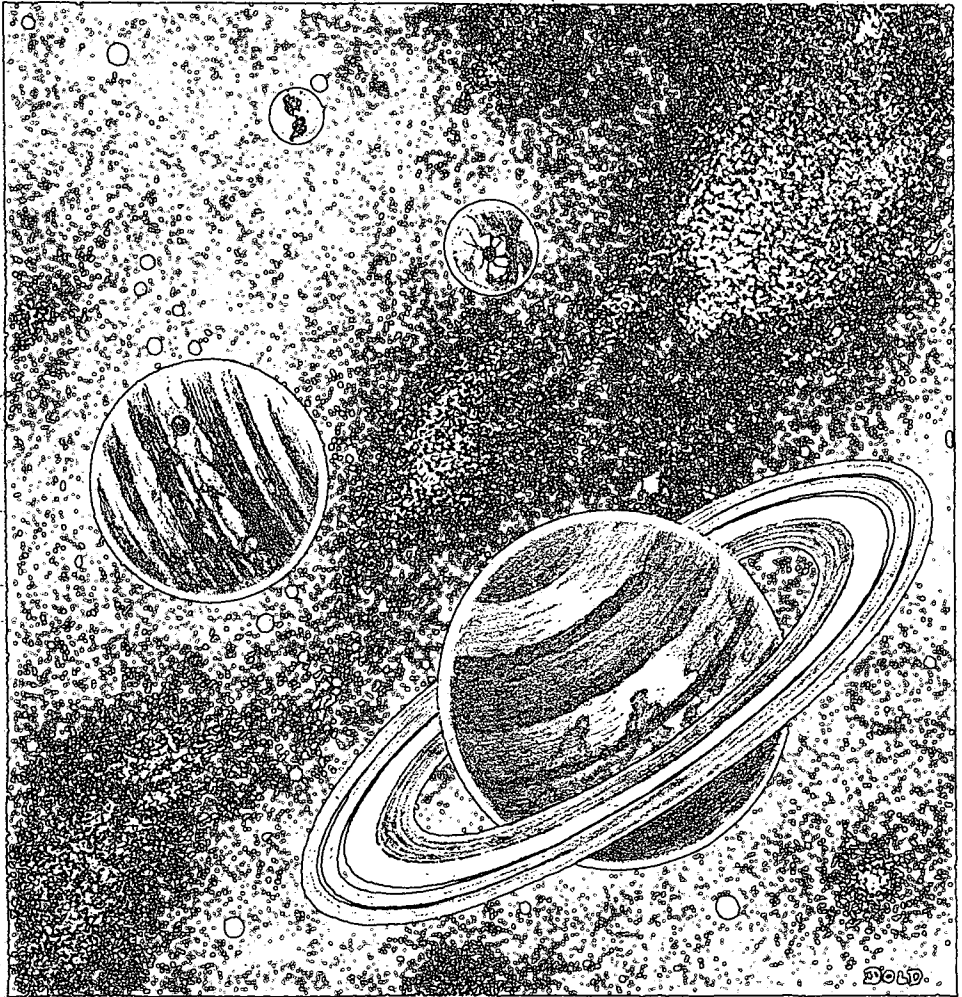
"Yes, Judson, he's all right now; his spells will never trouble him again. It's best, Judson; there was no other way for him. You may go now. I'll make the arrangements later."

Once more alone, I crossed to the still form. With a hesitation that belied my profession, I moved the black patch aside. Even in death the eye seemed to glare at me, a bright, fiery red. I thought for a moment of the wonders, and terrors, unknown to man that its retina could reveal; then, with a shudder, slid the patch into place and covered the still form.



A Study of the Solar System

Article No. 11 by John W. Campbell, Jr.



Beyond the Life Line

SATURN is beyond the life line of the solar system—880,000,000 miles from the Sun. There the Sun's light and heat have been spread in space, diluted by distance; from one of the planet's 9 satellites, the Sun would be a tiny, heatless disk of brilliance.

AST—6

But no living thing can be there to see it—not on those airless, frozen worlds. The largest of them is little more than 2,000 miles in diameter, the smallest we can see, through any telescope we have now, is 160 miles in diameter. For smaller ones, so far from us and from the Sun, do not reflect

enough light to be seen. All but Titan, the largest, is far too small to have held gaseous atmosphere.

And uniformly, they are cold—cold beyond any Earthly meaning of cold as applied to weather. What little air Titan may have must lie frozen or liquid at his poles. At the equator, in hot summer the temperature may soar to -170° C., but not at the poles. There, only hydrogen and helium could remain gaseous, and they have long, long been dissipated—dead, and useless worlds. The same logic that applies to the satellites of Jupiter applies here. Saturn, though smaller than Jupiter, is still 71,000 miles in diameter, 95 times more massive than Earth. It would never be a simple problem to escape the vast gravitational field of that planet, never be easy to visit and leave those 9 satellites.

Saturn itself is—probably dead, almost certainly lifeless. But of all the planets, Saturn has given us more impossible, contradictory facts than any other. Since the early 17th century, when Galeleo first turned a telescope on it, it has been a mystery. To-day it is still the most mystifying of the planets. We have “read the last chapter” of the 250-year-detective story that finally searched out the truth of the mystery of the rings, and to-day it seems obvious.

But remember that the men who solved that problem did not know the answers, and remember this, too: five of the greatest minds Earth has produced worked on that problem of the rings before it was solved; Galeleo; Huygens, the great Dutch mathematician and contemporary rival of Newton; Newton himself; Laplace, the great French astronomer, who proposed one of the earliest and longest-lived theories of the origin of the solar system; and James Clerk Maxwell, the second great mathematical physicist of the modern world, the man, who, working by pure

mathematical logic, predicted the hitherto unguessed radio waves. Ten generations of men were born between the night that Galeleo first saw the mysterious “wings” of Saturn and the time that Maxwell, the last of that quintet, finally solved the problem.

Galeleo's little telescope didn't give him more than a hint of the existence of some unknown structure floating in space close to the planet. He called the structure “wings,” and other astronomers observed the strange phenomenon. Then, 2 years later, they had disappeared. Nearly a half century passed before Huygens conceived the answer, and even then, in 1656, he was so unsure that his first publication was in the form of a cipher,* which he explained only after 3 years of thought and observation.

THIS RING THEORY so excellently explained the observed results that it was accepted fairly quickly. At that time, before Newton had announced his law of gravity, no serious objections were raised. To them it simply meant that Saturn was a sort of double world, a curious thing consisting of the usual sort of round, spherical world, and a second world of an unusual, but not impossible sort.

Newton's greatest contribution to the understanding of this first mystery of Saturn was wholly destructive. The astronomers had fallen into believing the idea of a ring—naturally a solid ring made out of dirt and stones.

It was not. Newton's Principia, and the law of gravity, showed three great faults, and the faults were not explained away for a period longer than the history of the United States.

* His original statement read: “aaaaaaaccccccde-
eeeeghiiiiiiiilllmmnnnnnnnnnnnooooooppqrrstttttuuuu-
u,” which he transposed in 1659 to read: “Annulo cingitur, tenui, plano, nusquam co-
herente, ad eclipticam inclinato.” Since every proper scientist of the day wrote and spoke Latin, it was clear enough that “it is encircled by a ring, thin, plane, nowhere attached inclined to the ecliptic.”

First, that flat, solid band might be thin—actually less than 50 miles through—but any structure 170,000 miles from side to side, even with an 80,000-mile diameter hole in the middle, was enormously massive. With gravity of a giant planet pulling, the solid ring would collapse, unless in swift rotation, so that centrifugal force would support it; but, second, it could not be rotating in that way, because to balance the weight of the inner ring meant a rotation so swift that the centrifugal force would tear the outer rim, nearly 90,000 miles farther out, to pieces. Third, even if it were rotating in balance, a deviation of the minutest trace, such as the attraction of giant Jupiter, would precipitate it with a thundering crash on Saturn.

The obvious answer (not so obvious as we, who already know it, would suppose) was that it was not solid, but already in pieces, rotating in orbits. But an entirely new spirit was rife in astronomy. Yes, that might be so, but can you give mathematical proof that those wildly heterogeneous orbits would be stable either?

No one could. Laplace, though, did what might be termed the next best thing: he gave mathematical proof that the only possible way to balance the solid ring would be to load one side, make it actually, a fairly ordinary satellite, revolving about Saturn, with a huge central mass of about $4\frac{1}{2}$ times that of the ring. The ring, then, sort of sprouted from the equator of the satellite, like the shadow of a man with his arms circled out before him, fingers touching, as it would be projected by a light overhead. And that was not so, since the great mass of the satellite was not seen, so it could *not* be solid.

But Saturn is given to *could not*s.

IN THE MEANTIME, Saturn was displaying other mystifying irregularities. Some of them were explained when Uranus was discovered. Saturn's

orbit had been varying, changing pace, in a way a good backfielder might envy. The astronomers, however, did not envy it. The discovery of Uranus, and the consequent explanation of some of the unknown, perturbing factors settled part of it; the Great Inequality, as it was called, remained.

Jupiter was perturbing Saturn, and being perturbed in return. The two mightiest planets of the solar system were attracting each other across the void with a force unimaginably immense. Jupiter's mass 1,200,000,000,000,000,000,000,000 tons, Saturn's nearly a third as great. Periodically, they pulled at each other in one direction, then for a while in the other. The mathematics of that was finally settled, but in the meantime, Cassini, an Italian observer, had noticed a new vaguery of the rings.

Saturn's rings are plural; there is an inner ring beginning only about 4,600 miles from the surface of the planet, then a break, another ring, another break, and finally the outer ring extending to a distance of 170,000 miles. The breaks now had to be accounted for in any mathematical explanation. Evidently, if the rings were made up of particles, the particles found orbits in these particular regions unstable. If there—why not unstable elsewhere?

Roche contributed something, too. He had studied the factors involved in the stability of satellites, and had discovered an important and interesting principle; when a satellite is near a planet, there is a tidal strain developed, naturally. Gravity falls off as the square of the distance increases. Then the near side of the satellite is pulled harder, tends to fall toward the planet more rapidly than the far side. This resulting force tends to break the satellite in two. When the disrupting force equals the gravity of the satellite at its surface—it is doomed.

Roche showed that a planet would dis-

rupt any satellite that came within a distance less than 2.5 times the radius of the planet. The outermost edge of Saturn's ring is 85,000 miles from the center of Saturn; $2\frac{1}{2}$ times the radius of the planet is 95,000 miles. Once Saturn was circled by 10 dead worlds.

James Clerk Maxwell at last developed the mathematics that explained the problem. It was not in some ancient and bygone time. Those rings were not explained until a date so recent that men living to-day can remember the first appearance of the solution. The mathematics that did it covered 60 pages, each somewhat larger than a sheet of typewriter paper. That paper proved that the meteorlike particles of the rings could revolve in free, stable orbits anywhere but at certain, specified distances. There should be no particles in those ranges. There should be—Cassini's division.

Saturn's innermost satellite, Mimas, is a 400-mile world, revolving about Saturn in about $22\frac{1}{2}$ hours. Next is Enceladus, a 500-mile satellite revolving in 33 hours. Then comes Tethys, 800 miles in diameter, revolving in 45 and a fraction hours. If a mass were revolving about Saturn in that blank space called Cassini's division, it would make the trip in just about 11 hours. Twice 11 is 22, 3 times is 33 and 4 times is 44. How long, do you suppose, an orbit in free space could be stable, when once every few hours 400-mile Mimas got in line and pulled; then Enceladus lined up and heaved, and every now and then Tethys laid violent hands on it? Maxwell showed it would not be stable. You will find that generally true: planets, asteroids, all such bodies, do not revolve in harmony; their periods never have a common factor so simple as 2, 3, or 4.

BUT when that had, at last, been settled, the orbits of the satellites had revealed another thing. Saturn had long

been known for its remarkable density, 0.73. It has even been called the "pea-soup" planet, which, one might almost say, unfortunately, it is not. Good pea soup is a lot denser; Saturn comes nearer being a "gasoline-soup" planet. Saturn is the weirdest world of the system. No science-fictionist in his wildest moments has proposed a planet with an atmosphere so incredibly contradictory. We now enter the land of "can be."

From the way the satellites move, they tell us the approximate distribution of Saturn's mass. Most of it is concentrated in the center; at the very heart the density appears to be somewhere around that of lead, not gasoline. The exact figures, we can't quite determine, but apparently there is an inner, solid core, 32,000 miles through, and about as dense as Earth. That core, then, accounts for 70 per cent, or so, of the mass of the planet. The remaining 30 per cent is in the atmosphere, a reasonable-sounding figure. Remember, all the major planets have immense, deep atmospheres. This one, we know from spectroscopic research, consists largely of methane, ammonia in small amounts, and a great deal of hydrogen and helium.

There is, however, just one slight difficulty. The average density of that atmosphere is $0.26-\frac{1}{4}$ as heavy as water. And its depth is 20,000 miles! That is something of an atmosphere. Earth, placed on that solid core, would make a fair mountain, but not much more. If our whole planet were placed on Saturn's core, and Venus lowered into position on top, and the whole planet Mars added to that, Mars' outermost edge would still be under an atmosphere denser than that planet had ever known! 3 worlds, one on top of the other, and they would still fall short! The pressures at the base of the incredible atmosphere amount to 10,000,000 pounds per square inch.

So—it can't be the kind of gas we know. If the kind of gas we know, obeying the laws we ordinarily experience, were put under that pressure, you could put all the gas in the *Hindenburg* in a coat closet. Actually, gases don't obey the same laws when you approach those colossal pressures; entirely new laws must be taken into account. But—gases compress, and you can't explain that low density by ordinary gases!

Liquids and solids don't compress. Perhaps, then, that atmosphere is actually a vast ocean? Perhaps, but what liquid? There are only two liquids that are less than one third as heavy as water; liquid hydrogen and helium, 0.07 and 0.12 respectively.

Saturn is tremendously cold, 180° C. below zero—terribly hot, for hydrogen. Hydrogen cannot exist as a liquid at that temperature. The temperature must be nearly 50° C. lower, before hydrogen can exist as a liquid, and it must be even colder for helium. So—that can't be a liquid ocean!

There are only 2 solid substances light enough to meet that density problem. Right; hydrogen and helium. And nobody has ever seen them solidify without turning liquid first. So, apparently it can't be glaciers of solid hydrogen and helium. No, by *reductio ad absurdum* reasoning, as the geometrician puts it, we are reduced to the total absurdity; it simply can't be.

BUT SATURN is the third largest fact in the immediate universe. We can't overlook it; there must be some explanation. The latest theory advanced in explanation is that while no man has ever seen solid hydrogen without the liquid first, it is possible, under immense pressures, to have the solid in equilibrium with the gas at any temperature! A hint of this is perhaps

found in "Ice VI." Ice VI is ordinary, everyday water under extraordinary pressure. Under those conditions, water is solid, dense ice at over 175° C., far above its normal boiling point.

If that is the case, Saturn is a mighty, 32,000-mile globe of rock and metal such as Earth, but incased in a colossal, overwhelming shell of solid, glassy hydrogen and helium, a frozen, infinite wilderness of mountainous masses of these "hot-solid" gases under immense pressure. Here and there dense outcroppings of bluish, heavy "rock" occur, crystals of solid ammonia. And, perhaps, an occasional mass of a rare, massively dense material more than 10 times heavier than the surrounding rocks—a densely heavy, crystalline stuff known, on warmer worlds, as water.

And overhead, vast clouds of ammonia and methane gas shriek by—vast gales roaring around a limitless world of frightful cold. Far overhead, beyond the dense, impenetrable clouds of the ultracompressed atmosphere, a vast arch of shining light belts the heavens—the rings. No eye exists to see them. They would be as beautiful as an eternal rainbow, from the surface of Saturn. But Saturn is dead. No life can exist on the cold world. Even if Saturn were warmed, it seems impossible that it could support life. Saturn is a world spoiled in the making. It is made wrong.

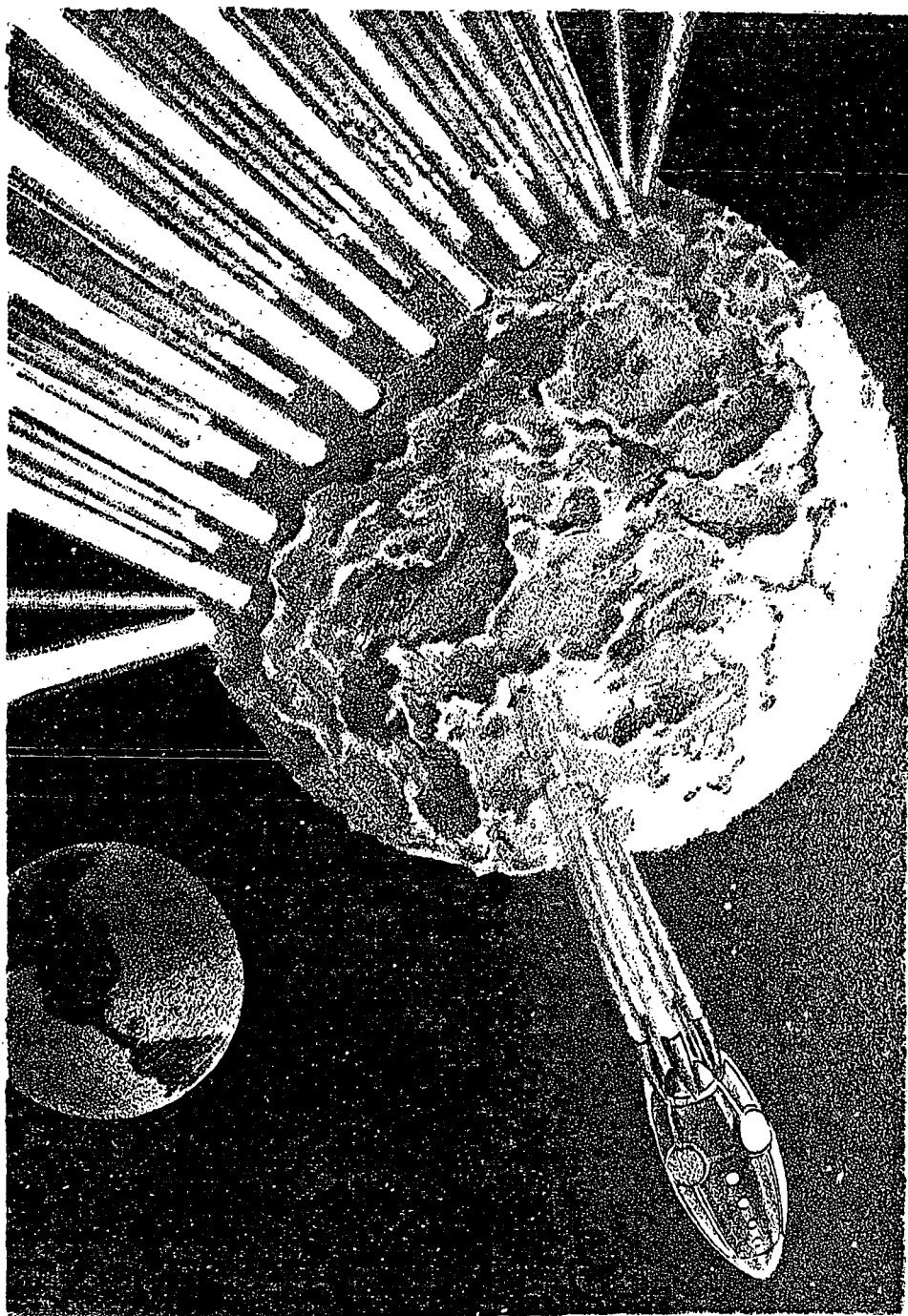
Beyond the life line of the solar system—880,000,000 miles from the Sun—Saturn and its 9 dead satellites circle. It must be dead; its composition is wrong. But—is that picture of the planet right? Are those vast, 20,000-mile, thick glaciers of solid hydrogen and helium real? Is that guess the true explanation?

Saturn—the more we have learned, the less we have understood.

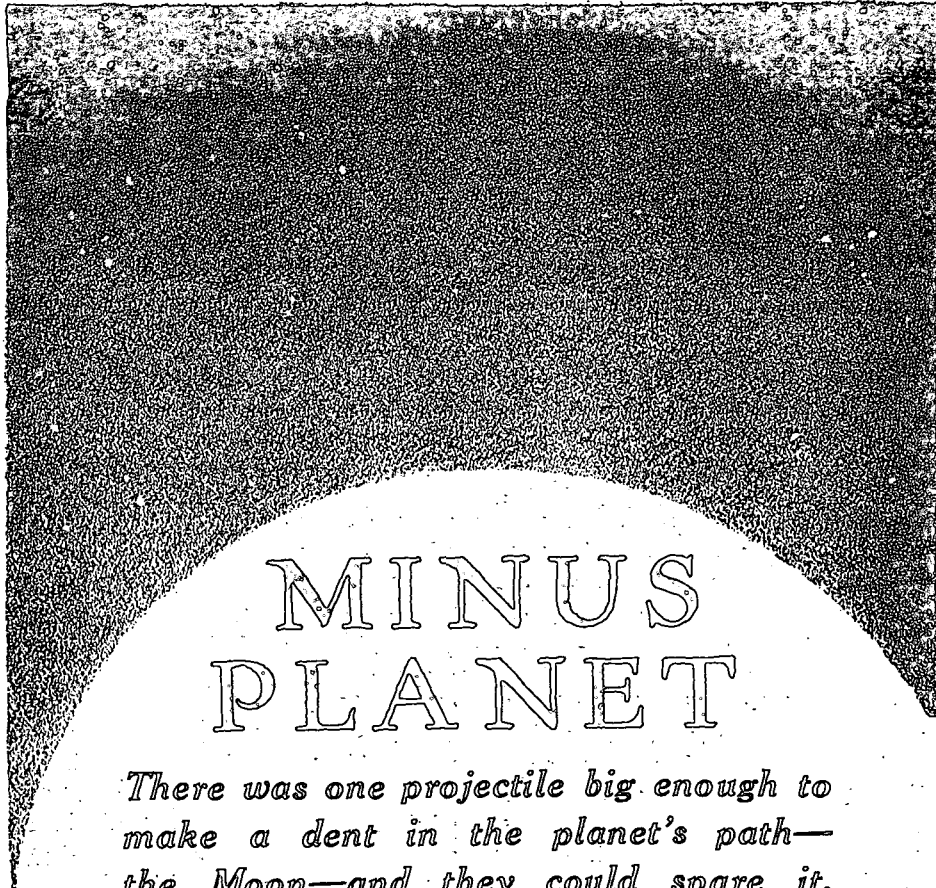
NEXT MONTH:

WEATHER REPORT

Article No. 12 by John W. Campbell, Jr.



There was the sudden, baffling sensation of weightlessness, as all acceleration left the ship, which was falling freely after the Moon—



MINUS PLANET

*There was one projectile big enough to
make a dent in the planet's path—
the Moon—and they could spare it.*

by John D. Clark, Ph. D.

NOW that it's all over, and we have escaped the more serious of the possible consequences, we wonder why we were so slow to see what was happening. For it might have been foreseen. We knew that the position of man in the universe was precarious enough, and that the very existence of matter itself wasn't much more stable. That is—we knew it, but we didn't realize it. There is a difference, and that difference was almost enough to eliminate not only man but the Earth itself from celestial history.

The warnings were plain enough.

They lasted for years. Biologists had noticed that the evolution of animal and plant life in the northern hemisphere was steadily accelerating, due, probably, to the gradual and completely inexplicable increase in the intensity of the cosmic rays from the direction of Polaris.

These rays increased the number of mutations in the germ plasm of all living matter exposed to them. New varieties of plants, freak animals, queer monsters born to normal men and women, were coming into the world at a steadily increasing rate. There were advantages, of course. Many of the

new varieties of plants and animals were extremely useful, and there were geniuses as well as monsters born to commonplace human beings. But, on the whole, the inhabitants of the planet didn't like the situation. The scientists liked it even less than did anybody else. You see, they couldn't explain it—and when a scientist can't explain something, he is likely to be annoyed. It makes him look so foolish.

IT WAS on January 15, 2156, that the astrophysicist, Dr. James Carter, had the first glimmer of light—literally. He was working on the new five-hundred-inch reflector of the Mt. McKinley observatory at the time, and noticed a darkening of his photographic plate from the spectrometer focused on Polaris in the northern sky. He repeated his observation, and got the same result; a uniform darkening over the whole spectral range.

"As though," he said to his assistant, "the whole damned spectrum were light struck! And I never knew any source of light that would give a continuous spectrum from infra-red to cosmic rays, with the cosemics the strongest. There doesn't seem to be any line structure at all—just as though there were a hot body out there heated to a few billion degrees centigrade!"

The assistant, Dr. Michael Poggenpohl, usually known as Doc Mike, wrinkled his diminutive nose, and scratched his flaming head. "That," he remarked, "doesn't make sense! A body that hot on the outside wouldn't stay that way. And where did it come from, anyway, Jimmy?"

Jimmy uncoiled his six foot three of giraffelike build from his usual thinking position (in which he rested comfortably on the back of his neck), lighted a cigarette, and grunted. The noise was not gracious, but neither was his mood nor the expression on his somewhat battered face.

"Right now, I want some information on where this alleged source of light is. Will you make arrangements for the observatories on Mars and Venus to take simultaneous observations with us on the northern sky? No, I don't want a spectrum. I *have* a spectrum, and it has me baffled. I merely want a simple photographic observation. Everything this object, whatever it is, is sending out, seems to affect the plate. And I want to know *where* it is. The question of *what* it is, can wait. Move on now, little one, and pretend that you're earning the money the commissariat of science is paying you!"

Mike held his nose insultingly, and moved to obey. "And how about the jack," he asked sweetly, "that they're foolish enough to waste on you?"

"It's not waste, old fruit. Geniuses have to be supported. I'm the genius!"

"I've been wondering what it was. I thought you must be somebody's uncle. O. K., I'll get the messages off right away. The light-beam operator ought to be able to get in touch with Mars directly; but Venus is on the other side of the Sun right now, and he'll have to relay to him."

"Don't bother me with trifles! Go away and let me think in peace!"

"You mean loaf," said Mike, and departed.

BUT JIMMY didn't loaf when the other man had gone. He reached for a dozen reference books, a slide rule, and a wad of paper, and immediately became oblivious to all about him. He remained in that state for some hours, and only returned to the world when Mike reappeared with the televised plates from the other observatories. They all showed the same thing: a small, brilliant point against the background of the northern constellations.

It had evidently been overlooked previously, since it was almost invisible to the eye, even through the largest tele-

scope, and appeared only on the photographic plate, which was sensitive to the invisible ultra-violet, gamma, and cosmic radiation which accounted for the major part of its energy. The plates were sent via pneumatic tube to the calculating room, with a request that the distance of the unknown body be determined, if possible, from the observations of the three planets. The two scientists sat down to think it over.

"Mike, what do you know about matter, anyway? What's it composed of?"

"What's the matter? I thought you were the genius. And why ask a kindergarten question at this time of day, anyway?"

"Go on, go on. I'm asking the questions. What's matter made of?"

"Well, if you must know, it seems to be made of assorted particles of electricity. An atom consists of a heavy, positive nucleus, with a lot of light, negative electrons floating around it. To be precise, the nucleus consists of, say, 'z' protons and 'n' neutrons. They weigh almost the same, and the protons have unit positive charges, while the neutrons are neutral. The whole nucleus has a positive charge, then, of plus 'z.' (Ordinary hydrogen hasn't any neutrons—just a single lone proton for a nucleus.) Then, of course, there are 'z' negative electrons floating around outside to neutralize the whole affair. You ought to know, though! You developed the method of splitting the nucleus on a commercial scale to get the energy out of it!"

"Yes, yes, I know. But what is a proton made of?"

"That? Oh, it seems to be a neutron closely tied up with a positron—a *positive* electron that doesn't weigh much of anything."

"Then, candidate, what are the fundamental units of matter?"

"What is this, anyhow? Another damned Ph. D. exam? The *fundamental* particles would be the neutron, with

most of the mass and no charge, and the positron and electron, with positive and negative charge respectively, and no mass to speak of. And so what?"

"Very good, Rollo. And now, what is light?"

"Hell with light! I can think of lots better things to discuss." He flicked the communicator switch, and the round face of the commissary clerk looked out at him from the view plate. "Send up two—no—four liters of beer! And make sure it's cold!"

Carter grinned like a ghoul, and slid farther down in his neck. "Make that six liters, will you? But this is serious. What happens when a positron meets an electron?"

"All right," Doc Mike said wearily. "You get a photon of light coming out of where the two met. Can be most any frequency—usually very high, cosmic or gamma. I wish he'd hurry with that beer! And what's this all about, anyway?"

"Wait and see—and get ready for a trip. I need the information on those plates, though, and several sets of observations some days apart. Here's the beer!"

II.

TWO WEEKS LATER two frightened scientists looked at each other over the final results from the calculating room. The figures were before them. The unknown, which continued to radiate faintly but continuously in its peculiar fashion, was some ten thousand million miles from the Earth, and was coming closer. And unless the gods of mathematics had completely forsaken them, within two years it would hit the Earth, or come so close to it that the latter would be as thoroughly wrecked as though it had sustained a direct hit.

The body was not large—no larger than the Moon—but its manner of radiation was unique. High-frequency light

comes from a hot body. And a body that small *couldn't* be that hot; it would have cooled off long ago. And if it *were* that hot, the intensity of the radiation received by the Earth would have been much greater—greater, in fact, than that received from the Sun, in spite of the small size of the unknown and its great distance from the Earth. It just didn't make sense. And it didn't make sense to the other astronomers of the solar system. Nothing had appeared in the popular press, nor was it likely to. An iron-clad censorship had been clamped down. The danger was serious enough, and panic would make it worse.

Carter spoke. "We're going out to take a look, Mike. Or I am, anyway. Would you like to come along?"

"Uh-huh. You need somebody to take care of you. When do we leave?"

"In half an hour. My ship is ready to go. It has a lot of new gadgets on it, too. This should be a good chance to try them out. Let's go."

Just half an hour later the rocket blasted free from the snow-covered space port near the observatory. It was an improved experimental model of those used at the time, all of which depended upon the principle discovered and developed by Carter himself, which had made space travel something more than an insane gamble.

Hydrogen gas was fed into the converter, where terrific static and magnetic fields converted it into helium. Immense energy, developed from the loss of mass, appeared in the process; which energy imparted a tremendous velocity to the flaming helium gas which escaped through the rocket jets at the stern of the ship. An acceleration up to ten times that of gravity could be maintained, but five gravities was the usual limit for any length of time. More than that, and the passengers lost consciousness. Five was uncomfortable enough, but men in good training could stand

it, if they didn't attempt to move from their padded and pivoted chairs.

The trip was uneventful. A week later the rocket was circling cautiously around the unknown body. It was about the size of the Moon, but little could be seen of its surface, which appeared to be under a continuous bombardment with some immensely high explosive. The flashes from the explosions, consisting mainly of cosmic, gammas, and UV's, were evidently the source of the light which had puzzled the observers. Carter and Poggenpohl crouched behind their lead-glass screens and watched.

"Looks like a fluorescent screen being bombarded by electrons, Jimmy. Somewhat larger scale, though. More bombardment on the forward side, too."

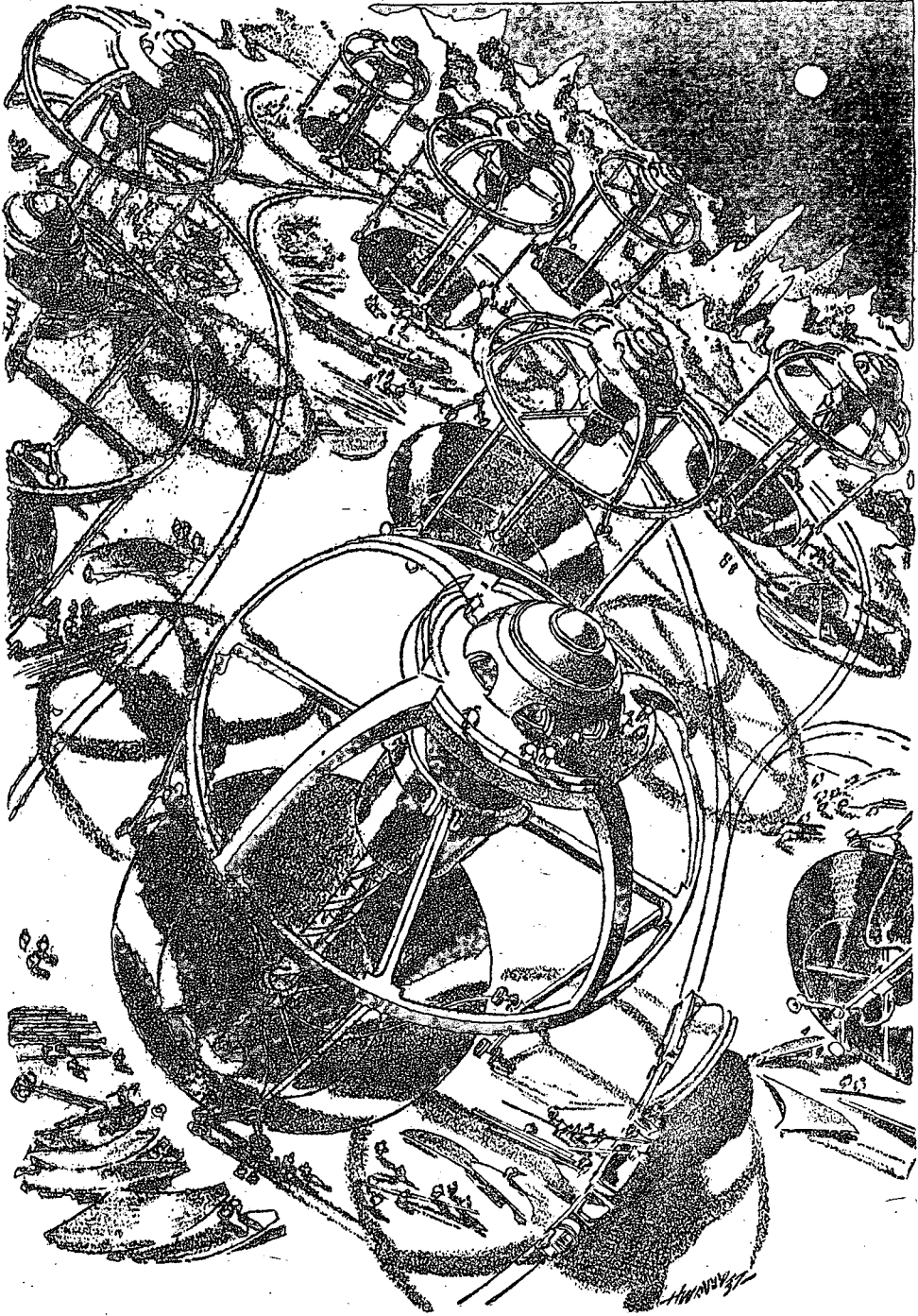
"Yes, there is. It looks as though it were sweeping a path through space as it approaches the Earth. Man that gun, will you, please, and fire a solid shot at it when we go around the rear of it again?"

"O. K. Don't see what you're driving at, though. Do you expect a bell to ring, like in a shooting gallery? I'll signal when I fire, and aim directly at the center when we're exactly behind it."

The minute went by, then, "Ready—fired! Watch for it!"

There was no need to watch. Twenty minutes later, when the hundred-pound piece of steel hit the surface of the wandering planet, there was a tremendous flash, dwarfing those which had been observed.

Carter appeared to be pleased, or at least satisfied, and called to the other. "All right, Mike. I'm going to cut the rockets and let the ship take up an orbit around this peculiar object. You take the measurements of distance to the surface and time the orbit, and I'll measure its diameter. Considering the fate of that piece of steel you sent out of the gun, I don't think we'll land this time. It might be unhealthy."



Then the huge atomic drills, operated by men in space suits, started the excavation of the deep shafts that were to act as rocket tubes.

THERE FOLLOWED a period of several hours, during which the only sound was the click of the calculating machine, and Mike's gasp as he saw the final result. "Good Lord, Jimmy!—This cockeyed animal isn't any bigger than the Moon, and she weighs as much as Jupiter! Are we nuts—or is it?"

Jimmy laughed as he cut in the rockets and swung the ship around for home. "The latter, Mike! *It's* demented—completely. We're no crazier than usual. Gather around and I'll explain."

"It's about time! Now, *what* have you got up your sleeve, anyway?"

"You remember, when we first saw this thing, I put you through a quiz on matter? I had a hunch then, and I've proved it. You described the sort of matter with which we are familiar. Look here. You said that matter was made up of neutrons and positrons, in the last analysis, in the nuclei, and of electrons on the outside. Well, there is another sort of matter possible. What is to prevent an *electron* from combining closely with a neutron, and forming a *negative* proton? The possibility was mentioned way back in 1934, and I think the old boy even gave his hypothetical particle a name—an 'antron,' I think he called it. Now take some of these antrons, and some extra neutrons, and make a nucleus out of them, and then release enough positrons on the outside to balance the antrons. And one has an atom with a *negative* atomic number, since the atomic number of an atom, of course, is the number of positive charges on the nucleus.

"And now one makes a whole universe with these minus elements. And one makes oneself out of them, too, and lives in the place, and can't tell the difference between it and a regular universe. All the physical laws will be the same—but just wait until part of your new universe hits part of a regular universe! Then there'll be the devil to

pay and no pitch hot! Figure it out. What do you think will happen?"

"Uh—let's see. First the outer electrons in our matter will neutralize the outer positrons in the reverse matter—and there'll be a hell of a lot of light or other radiation—UV, gamma, cosmic and what not. Then the nuclei will get together. Nothing will happen to either set of neutrons. But the positrons on the protons will neutralize the electrons on the antrons, and there'll be another burst of radiation and a lot of neutrons left over. So the net result will be a mob of neutrons and a flock of radiation. What do you think? Is that thing out there"—he gestured toward the anomalous planet they were leaving behind—"out of a reverse universe?"

"I think so. It has all the symptoms. Long, long ago, how long ago, Heaven only knows, it escaped from some nebula in outer space—some nebula that's built in reverse—and headed this way. And here it is. The glowing and flashing surface is the result of its contact with cosmic dust—the little particles of matter that drift around through all space. And every time it picks some up there's a flash; all the charged particles are neutralized and head away from it as light. And it has added a few more neutrons to its collection. They probably sift down to the center of gravity of the thing. That's why it's so infernally heavy."

"Then, teacher"—Mike was having an idea—"it was probably a rather ordinary planet when it started out on its travels. Barring being built backward, that is! I'd make a guess that it was about half the mass of Jupiter when it started, and, I suppose, had about half the volume. But every time it picked up some normal matter it both shrunk and got heavier. The mass of the positrons and electrons lost would be too small to lose sleep over, and, on the average, it would pick up one neutron for

every one of its own freed from a nucleus.

"So it's 'most used up now—an awful flock of neutrons left, and just a little bit of normal reverse matter. The neutrons will have most of the mass, and the reverse matter will take up almost all of the space. Neutrons don't take up any volume to speak of."

"Right. So now it has twice the mass if started with, approximately, and a minute fraction of its original volume. When the rest of the reverse matter is finally neutralized it will be a little heavier, and so small that it'll be completely invisible. Maybe there'll be a few cubic centimeters of neutrons, or some absurd amount like that, with all that mass. But we'd better hurry! It won't be very amusing if that neutralizing is done with some of the Earth's surface! Hold tight—here comes some acceleration!"

III.

TEN DAYS LATER Carter and Poggenpohl presented their report to the commissariat of science of the United States of America, and two days later they attended an emergency meeting of the heads of the departments of science of the governments of the world. Carter was speaking.

"So you see, gentlemen, what the situation is. You all understand the theory of the phenomenon, and you know that the observatories of the world and of the other two inhabited planets have checked our own telescopic observations. In addition, there is the phenomenon we observed when the six-inch projectile hit this—this——"

"Call it 'Gus,'" whispered Mike, respectfully.

Jimmy glared at him, and continued, "—this—minus planet. I am aware of no alternative theory to explain the behavior of this anomalous body, and most of you appear to be inclined to adhere to the one Dr. Poggenpohl and I have

presented." He looked around the table and saw nothing but a succession of reluctant nods.

"Then, the question is, what to do about it? If it were normal matter it would be bad enough. But then, it might be possible to install huge rocket tubes on the intruder and drive it out of its course sufficiently to miss the Earth by a safe margin. But what can we do with this thing, when, if we touch it, we shall be annihilated? And if we don't touch it, we shall be annihilated anyhow. At least the Earth, and those who can't escape to the other planets will be annihilated, and that means ninety-nine per cent of the population. For you know that our combined rocket fleets aren't enough to move one per cent of the Earth's population in the time we have available. And even if we could move them—the other planets are only barely inhabitable by man, and certainly could not support all of us."

"There's one thing we must do," remarked the science commissary of the Russians, "and that is to keep this situation a secret, for the present at least. For if we don't, there will be such a rush for the few rockets we have that half the world's population will be killed in a few days in the panic. And the rockets themselves will be smashed. We won't be able to do anything at all with them."

"There's no doubt at all on that point," said the delegate from the Federated States of Europe. "I take it that the meeting is unanimous on that point?" There was another chorus of nods, but this time more enthusiastic. "But has anybody any idea of how to move this—minus planet—out of the course it's following?"

There was a sodden silence, and then Mike rose slowly to his feet, his red hair bristling with what looked like an idea. "Gentlemen, there's one other way to move our little country cousin out of his course. Hit him with some-

thing heavy that's moving fast enough to do the job."

"But what will happen to that thing, whatever it is? Won't it be annihilated?"

"Not so you could notice it, when it comes to the effect. All the electrons and positrons will be gone, and it won't be normal matter any more, but the neutrons will be left, and they will have the momentum they started with."

"Very well, Herr Poggenpohl, but what can we hit it with that will be big enough to make any difference? All the space ships in the solar system, firing all their biggest guns for a year, wouldn't be enough to do anything to its course! After all, it weighs as much as Jupiter!"

"There's one projectile available that would be big enough to make quite a perceptible dent in its path: the Moon! We can spare it. All it does is produce the tides. Mount rocket tubes on the Moon, pry it up out of the solar system, and sock the intruder so that its course will be changed and it will fall into the Sun! We can do that if we hit it while it's still far enough away from the system."

THE COUNCIL gasped at the suggestion, and there was a chorus of excited protests, which slowly died, as the sheer magnitude of the plan gripped the imaginations of the assembled scientists. Nobody thought of putting the question to a formal vote, and in twenty minutes the meeting had been changed, automatically, into an executive council, which was in an excited argument about ways and means, in which calculating machines, reference books, celestial mechanics, the quantum theory, and polylingual profanity played a prominent part.

Carter pounded on the table and shouted until he managed to attract the attention of the disputants. "Gentlemen," he said, "I suggest that we present our plans to the various

governments, in order to obtain their cooperation in the execution of our project. And I also suggest that publicity can do no harm now, since we have an apparently practicable remedy for the difficulty. The amateur astronomers will let the cat out of the bag very soon, anyway, if we don't make some statement. And finally, may I suggest that we request the President of the United States to make a television broadcast, explaining the situation to the public, asking their cooperation, and assuring them that the said situation is, as it were, well in hand?"

The assembled scientists stared blankly at him, nodded absent-mindedly, and returned to their discussion, more violently than before. Carter grinned at Mike, lighted a cigarette, and wandered out of the room, in search of a communicator in some place that was quiet enough so that he could make his message to the President heard above the din.

The President revealed the danger to the world in one of his famous fireside broadcasts, concluding with a request that every one remain quietly at his normal duties, unless called upon to cooperate in some way with the scientists who were working at what appeared to be a practicable method of saving the planet.

The heads of the other governments of the world made similar broadcasts.

As might be expected, most of the population of the Earth paid no attention at all to the broadcasts, being quite unable to realize the situation. The Earth had never been destroyed, therefore it could not be destroyed, and the scientists were crazy as usual. That attitude was typical of the major part of the inhabitants of the globe—the great, average masses.

But there were two other attitudes apparent. On the one side there were those intelligent enough to understand the danger and the measures that were

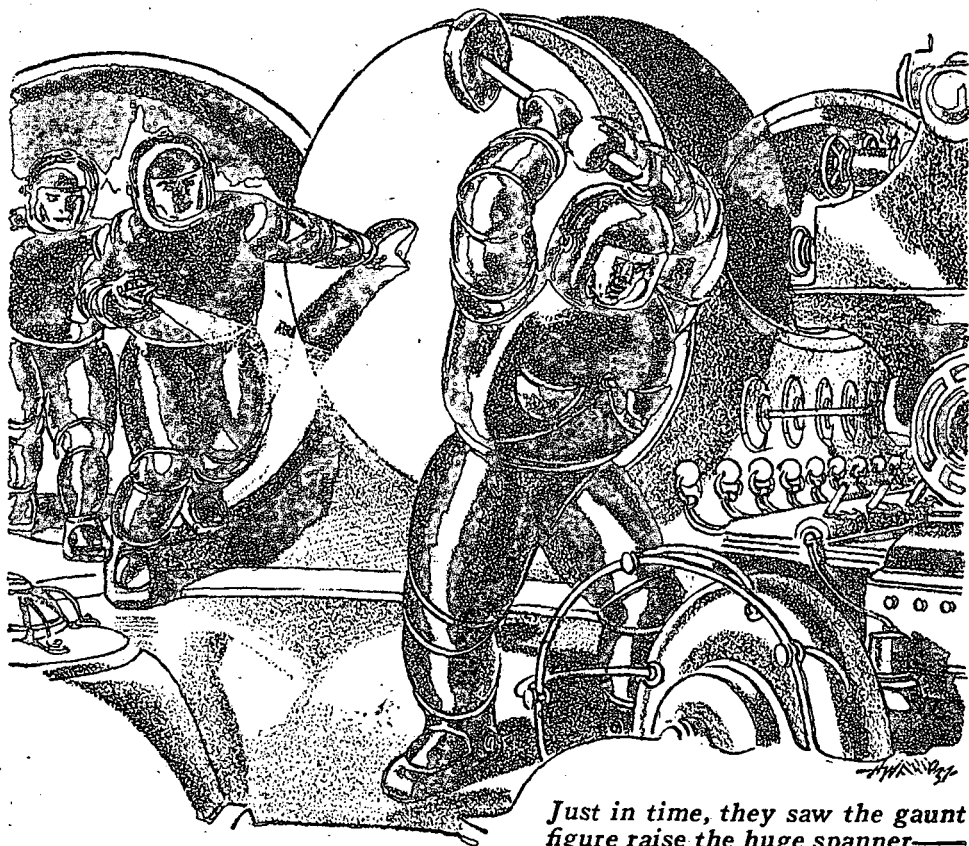
being taken against it. They were the scientists, engineers, and technicians of the world, and the well-educated part of the other classes of the population.

On the other side were the unbalanced, the fanatics, and the extremely ignorant, who were the tools of the first two. They rioted, for no apparent reason, but merely because they were frightened; they tried to make up in two years for the dullness of their lives, not realizing that the dullness of those lives was largely due to the dullness of their intellects. Some of them—and they were less trouble than the others—merely got drunk and remained that way. A few of them actively obstructed the work that had to be done.

One of them, one Obidiah Miller, who had been, it was rumored, a circuit rider in the Tennessee Mountains, was

the most virulent. He was an ignorant man, but he possessed a native shrewdness which, combined with his surprising oratorical powers and his religious fanaticism, had a tremendous effect on the more ignorant and weak-minded portions of the population.

Fanatics are always followed by fools, of which there is an inexhaustible supply. When the danger appeared, the intelligent parts of the populace decided that the reasonable thing to do was to coöperate with the scientists who were trying to cope with it. The fanatics proclaimed, and the fools believed, that the approaching calamity was the judgment of God on an impious world. Especially did they protest that the Moon should not be moved. First, because it couldn't be moved; second, because the Lord hadn't intended it to move; and



Just in time, they saw the gaunt figure raise the huge spanner—

third, because, since God had evidently intended that the minus planet should destroy the Earth for its wickedness, it would be an act of impiety even to attempt to avert the collision.

"Would ye seek, brethren, to attempt to stave off the Day of Judgment, as foretold in the Holy Scriptures? Would ye seek"—his hill-billy accent rolled out over the sheep-faced crowd—"to avert the day when the righteous shall be raised to the right hand of God, and the wicked shall be cast down to Hell? Will ye let the wicked meddlers into matters that are best left alone attempt to stave off the almighty hand of God? Wreck the space ports! Smash the rockets! Kill the idolaters!"

There was an answering rumble from the crowd, as Mike and Jimmy slipped away from its outskirts. "The 'idolaters,'" Mike remarked, as they sidled into a building, "sounds like us. I would recommend, with all due respect to the gentleman's religious convictions, that steps be taken. With an ax, for choice, before he starts gumming the works."

"There appears to be something in what you say. Personally, I have no desire to become a martyr to science before it's absolutely necessary. Let's get the chief of the Federal police on the wire, and have him gather our friend in and send his congregations home. And some guards with machine guns and things around the space ports might not be amiss. We haven't any time to be bothered by fools!"

IN THE NEXT FEW DAYS there was an epidemic of raids on the pseudo-religious protest meetings, and there was a great gathering-in of the more rabid of the fanatics, including Obidiah Miller, who was planted, gently but firmly, in a lunatic asylum. Guards were placed around the space ports, and assigned to the more important of the scientists who were employed on the gigantic task.

There were a few attempts at sabotage and assassination, but all of them failed.

The work was pressed. The astronomical observatory on the Moon was dismantled and carried to the Earth piecemeal, as were many of the valuable fittings of the space port there. Since the development of atomic power, this port was not as necessary as it had been in the old days of combustion rockets. Then, the huge atomic drills, operated by men in space suits, started the excavation of the deep shafts that were to act as rocket tubes. Some fifty of them were drilled, most of them parallel, but a few at divergent angles, to act as the steering mechanism of the huge space ship into which Luna was being converted. At the bases of these shafts the reaction chambers were excavated, and lined with refractory material. The automatic fuel-supply system was installed, whereby millions of tons of the very material of the satellite itself were carried to the reaction chambers.

There, the lighter elements, oxygen, silicon, aluminium, etc., were to be converted into iron vapor, which was to be driven out of the rocket tubes by the atomic energy released in the process. Iron itself, though common on the Moon, was not suitable as a fuel, since, in respect to *atomic* changes, it is the most stable of all the elements. The whole fuel system was automatically controlled, with all controls in duplicate.

The controlling mechanism, which consisted, in effect, of fifty throttles—one for each rocket tube—was arranged to be controlled by remote radio control from a space ship, which would convey the huge projectile to its destination. All the rocket tubes, of course, were on one hemisphere of the Moon, since there would be no need of stopping it in its course, once it had been started.

Thousands of men were needed for the construction work—of all types from manual laborers to astrophysicists. And

all of them were working at high pressure. Work never stopped for months at a time. Accidents were many—an atomic drill is not the safest instrument in the universe, and working in a space suit is always dangerous.

As a result, the work took a steady toll of lives, and there was a steady inflow of new labor onto the job. But the work went on in spite of accidents. It had to. When a man was killed, if there was anything at all left of him, the body was tossed to one side and another man took his place. The record of the construction would be an epic in itself—one which there is no space to record here.

The plan of operation was simple—in theory. The Moon was to be gradually dragged away from the Earth—gradually, to avoid inducing huge tides and devastating Earthquakes, then driven north “above” the solar system, out of the plane of the ecliptic. It was to be driven into the minus planet at such an angle and at such a velocity that the latter would be deflected away from the Earth, and the residual mass of neutrons would fall directly into the Sun, where they would do no harm. It was calculated that the normal matter of the Moon would a little more than neutralize the negative matter of the minus planet, so that the residue that finally reached the Sun would consist of a small planetoid of normal matter surrounding an extremely massive core of neutrons.

IV.

IT WAS July 6, 2157. Carter and Poggenpohl were rechecking the calculations of the course the Moon would have to take on its last voyage. Finally, they finished with the last decimal and leaned back. “And that, my boy, is how it shall be done!” Jimmy threw his pencil at the calculating machine and inserted his face into a liter of beer.

“All you have to do is push the but-

ton and save the world. We'll have to do some reckoning, though, on the initial escape from the Earth. Otherwise, if we're a little brusque about it, the tides will put New York under fifty feet of water, and the mayor might possibly be annoyed with us. How far behind schedule are those Primates of engineers, who are supposed to be building the rocket tubes on that soon-to-be excompanion of our more romantic moments?”

“They ain't. Bill Douglas was here last night, and he said that they would be ready to go in two weeks. And we have three to spare. He's a week ahead of schedule. There's just a little more wiring to do. And we don't have to do any calculating on tidal effects, either. I did it myself a month ago. It won't be as tough as it looks—a gradual acceleration of the Moon's velocity in its orbit, and a gradual, simultaneous acceleration away from the Earth. I planned those rocket tubes, too, so that they won't shower the Earth with vaporized iron. They won't point this way until they're a long way from here. You stick to my firing chart, and you'll get away with it. And I figured what the tides would be, too, so you don't have to worry about that. I done it with my little calculator!”

“I say—I thought I was the genius around here! I'll have to have the brass hats increase your salary fifteen, or possibly twenty, cents a week!”

“You don't have to worry about that, either!” Mike grinned like a gargoyle. “I've already attended to it. I caught the commissary of science in a good mood the other day and hit him for five hundred dollars more per week. Got it, too. In fact, it's already spent. You're invited to come and help drink some of it to-night.”

“Accepted without qualification. How about those tides, though? How bad will they be?”

“Not so bad. About three meters

maximum above mean high water along the coast. They've almost finished building concrete sea walls around the cities and the important communications along the coast, and they're evacuating the other coastal lowlands. But *you* wouldn't know about that. You've been too busy with that trick integrator of yours to know whether you're alive or——"

A BUZZ of the communicator interrupted Mike. He flicked the switch, and the agitated face of the chief of the Federal police appeared on the screen. "Dr. Poggenpohl! That nut, Obidiah Miller, escaped from the loony bin last night! We haven't been able to track him down. Probably get him in a couple of days, but watch yourself in the meantime, and warn Dr. Carter. I'll send over a couple more guards. No sense in taking any chances now."

"Thanks, chief. I'll warn Dr. Carter. But there isn't much our little friend can do right now. The job's almost done. Thanks for the warning, though." He flicked off the switch. "Oh, hell, nothing we can do about it! I only hope he stays away from here. I *don't* like nuts. They get in my hair. And by the way, there's another guy who is cursing us up one side and down the other. The power commissary is quite wrathful."

"We're taking the Moon away from him, and he can't produce any tidal power any more. He'll have to rip up all his plants and convert them into atomic-power outfits. He doesn't love us. He wants to write off the original investment on the old plants, so that his department can make a good showing. And they didn't have any upkeep to speak of, and the power was free and required no brains whatever to produce. So, as I remarked, he does not love us. In fact, I think that he'd like to boil us in oil or do something else equally lingering and humorous to us."

"Oh, well. Invite him to the party. Perhaps, if we get him tight-enough he won't mind it so much."

V.

IT WAS August 1, 2157. The last of the construction crews had been removed from the Moon; all the valuable equipment had been returned to the Earth, and everything was ready for the start. The control space ship was waiting for Carter and Poggenpohl, who were to guide the Moon on its last journey. In twenty hours, at exactly 16:27, GMT, August 2, 2157, the first rocket was to be fired.

Mike had strolled out to the ship, where he was intent on inspecting his quarters, when there was a frantic ringing of alarm bells, and a white-faced field attendant raced across the field. "Dr. Poggenpohl! Stop! There's trouble on the Moon! Just got word. A——" He stopped suddenly as Jimmy ran up alongside of him.

"There's going to be hell, Mike! That damned nut Miller's gummed things. When he got loose he got himself included in one of the last construction crews on the Moon, and when they left for Earth he hid and stayed there. And he's wrecked the remote-control apparatus completely!"

"How do you know?"

"He had to brag about it. He called me up on the communicator three minutes ago and told me what he'd done. Just wanted to rub it in. He's a martyr, of course. Perfectly willing to die with the Earth if he can keep everybody else from living. And there isn't any time to fix the control; we have to start in twenty hours, come hell or high water. And *they'll* both come if we don't. Wait until I catch that messiah! I'll roast his liver over a slow fire!"

"What are you going to do about it, Jimmy? That damned minus planet will

rip us out by the roots if we don't do something fast!"

"I'm going to the Moon and run the thing by hand. Tell them to get the experimental rocket ready."

"The hell you say! You'll get yourself annihilated! And how are you going to do it, anyway?"

"Oh, there's an auxiliary control for the tubes on the Moon itself, off to one side of the rocket area. Rather on the edge, between the rocket hemisphere and the forward or blank hemisphere. I can control it from there—if I can get there before our friend Obidiah thinks of smashing it, too."

"Maybe so, but you'll get yourself killed just the same. How are you going to get out from under when the two hit?"

"I'll have the rocket parked alongside," said Jimmy, "and dive into it when I have Luna lined up for a direct hit. I've a pretty good chance—maybe one in ten, or so. I'll go alone, of course. There's no sense in anybody else's taking the chance."

"That's what you think!" Mike's red hair bristled even more belligerently than usual, and he glared up at the other's face. "I'm going along. You can't handle that brute alone for a week—you're just nuts! And if you can draw to an inside straight, so can I!"

"Hey!" he shouted across the field. "Provision the experimental rocket for two men for four weeks! And make it fast! I'll tear your liver out if I have to wait twenty minutes!—Jimmy, get your gun! We'll have to settle with Obidiah."

Nobody's liver was torn out. Fifteen minutes later the little rocket roared clear of the field with the two men inside. Ten hours later they were in their space suits, bounding in long, ungainly leaps across the Lunar landing field toward the control room. In the helmet radio, Jimmy could hear Mike cursing fluently in three languages. "Lord," he

thought, "if that ape has smashed things already—then we *shall* be in a jam!"

THEY REACHED the control cubicle, and peered in the ports. The control board was invisible from there. They crept into the air lock. As the inner door swung silently open they saw a gaunt figure in a space suit raising a huge spanner over the main controls.

Jimmy's gun roared. The figure pitched forward between the levers, and the spanner clanged to the floor. "This is no time for chivalry, Mike. Throw that thing out the air lock, will you, while I see if the controls are all right? The fool must have just remembered the direct controls. It's lucky that we arrived when we did!"

It was August 2, 2157, 16:24 GMT. The rocket had been moored by huge steel cables, with a quick-release arrangement, against the door of the control room. Three minutes to go.

Both men were in the padded and pivoted chairs before the control board. "We, who are about to die," Jimmy said casually, "salute you. Is everything ready?" He swung the safety-release lever over, activating the control buttons. "Will you tell them that I died in the odor of sanctity?"

"No," said Mike, "I will not. Your odor is not of sanctity. It reminds me more of beer. You may fire when you are ready, Gridley!"

Jimmy glued his eyes to the firing chart, and his fingers to the first bank of buttons. Twenty seconds to go. Mike shivered a little, and tried to disguise the shiver with a yawn. He started counting seconds.

"Ten—nine—eight—seven—six—five—four—three—two—one—fire!"

There was a shattering, ground-transmitted roar. The Moon under their feet trembled, and through the ports, silhouetted against a hellish glare, they saw the construction scaffolding fall to the ground. The roaring increased. It was

like a continuous explosion. Mike tore his handkerchief into bits, stuffed pieces into his ears, and did the same for Jimmy, who was too busy with the controls to do anything for himself.

The roar increased and the flares waxed to an absolutely unendurable brightness, and there was a feeling of acceleration, as though the floor beneath their feet were tilting. Mike covered the ports against the glare, and sat down again. He lighted two cigarettes, one of which he placed in Jimmy's mouth.

The wall against which the rocket was moored had become the floor. The Moon was traveling faster than it had for millions of years, and was gradually drawing away from the Earth. They had no instruments with which to observe the latter, but Mike could imagine the growing tides, the tremblers, and the spectacle in the sky. "I hope they make movies from the Earth," he remarked to nobody in particular. "I'd like to see them if we ever get out of this."

He broke open some food and water, ate, and took the controls while Carter ate, and then, plugging his ears more thoroughly, lay down on an air mattress and went placidly to sleep, after setting an alarm to wake him, with an electric shock, after six hours. Any alarm depending on sound for its effect would be completely useless.

When he awoke and took the controls, the Earth was far behind, and the minus planet was a brilliant spot on the view plate, a little left of dead center. It was coming closer all the time. The roaring of the jets continued unabated. The whole hemisphere of the Moon "below" them, when he ventured to look, was one white glare, with the incandescent iron vapor shooting hundreds of miles into space.

AUGUST 12th, 3:28: The last watch was in progress. Jimmy was at the controls. Both of them were in their space suits, and the doors of the

control-room air lock, which now appeared, because of the acceleration, to be below them, were wide open directly over the open, outer door of the air lock of the rocket, into which a rope dangled from a stanchion beside the control board.

The minus planet was visible through the port in the opposite wall—now the roof—filling most of the sky, and rapidly growing larger. The acceleration was still at maximum, as the greatest possible velocity at the time of the collision was not only desirable but necessary. The seconds sped, and yet dragged, as the minus planet grew.

3:30: Jimmy held up two fingers. Two minutes more! He waved Mike toward the air lock. The latter looked around the room to see if he had forgotten anything, and then slid "down" into the rocket's air lock and grabbed the control that would free the moorings.

3:31: The minus planet was bigger—much bigger. It filled most of the sky. Mike gazed anxiously up at Jimmy.

3:32: Jimmy leaped from the controls and slid down into the air lock. He tossed out the rope as Mike released the moorings and slammed the outer door of the lock. There was the sudden baffling sensation of weightlessness, as all acceleration left the ship, which was now falling freely after the Moon, toward the intruder. There was a *whoosh* as they opened the inner door, not waiting for the pressure to equalize, and pulled themselves by the guide rails toward the control cabin. The gyroscopes were already turning over at full speed, and the rocket tubes had been warmed up.

3:34: Mike slammed himself into the control seat, swung the stick which controlled the motors turning the ship around the stabilizing gyroscopes, and, heading her out to one side of the impending collision, jammed on the maxi-

mum safe acceleration of five gravities. Jimmy had managed to reach a chair, and was attempting to pull off his space suit, but the acceleration forced his arms down by his sides, and almost pulled him through the seat of the chair. Mike shoved the acceleration up another notch, and switched on all the view plates.

4:45: The acceleration was still on at six gravities, but neither of the men were interested in it. Their eyes were glued to the view plate, which bore on the impending collision. It was a matter of seconds. Already the Moon was breaking up, and most of the rocket tubes had gone out. Then——

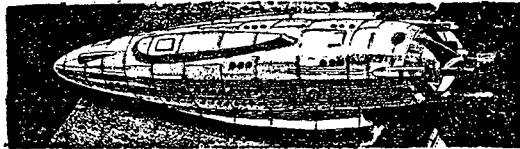
There was a blinding flash on the view plate, and it went black, burned out by the tremendous impact of the radiation. Mike cut the acceleration to zero, and fainted. But Jimmy didn't know it. He was unconscious.

ABOUT AN HOUR LATER they came to—bruised, battered, and burned by the radiation which had filtered through the supposedly ray-proof walls of the ship. They switched on an acceleration of half a gravity, so that they could navigate comfortably in the rocket, and swung her ninety degrees around the gyros, so that they could see the remains of the intruder through the side ports. The view plates were useless. There was a small, incandescent planetoid falling toward the Sun. Mike turned a spectrometer on it, gazed a minute, and then grinned all over his blistered face. "It looks like we've done

it! There isn't a damned bit of minus matter left on the thing. It glows like a normal hot body—like a young Sun about the size of Ceres."

Jimmy tried to grin back, and couldn't. His face hurt too much. "Right-oh! The Moon neutralized the last of it, with some left over. There's nothing there now except neutrons and some white hot iron, silicon, and what ever else the Moon was made of. It's terrifically heavy, and it's hotter than the seven hinges of hell, but it's nothing to fear. It will fall into the Sun in a month or so. But *you* look like the way I feel, and that's like the latter end of a misspent life. You'd better strip. I'll get the antiburn goo from the medicine chest, and we can butter ourselves up. Then, we can let the ship coast a while while we get some sleep. And finally, if there's enough of her left to navigate, we can wend our way homeward. But sleep is what I want most right now——"

Two weeks later, two tanned and filthy astrophysicists stepped out of the air lock of a burned and blistered rocket onto the tarmac of the space port at Washington, stopped short, and gazed with horror at the galaxy of gold braid and blazing stuffed shirts that approached them. They glanced from side to side with the expression of hunted animals, and then, with the mein of early Christian martyrs, stepped forward to undergo the horrors of an official reception by the combined governments of the solar system.



Down the Dimensions

At some "punctus" in himself was his corporeal self—starting on the journey into himself—as he now was— And thus it would be—endlessly—

by Nelson S. Bond

BRADNER CHUCKLED. Even a scientist known to his fellows as "Old Cautious" was not without a sense of humor—and humor there was, as well as glory, in the journey he was about to undertake.

Only a few weeks before, Bradner had seen a pseudo-scientific feature in a neighborhood motion-picture house. Thinking now of the marvelous—well-nigh unbelievable—laboratory that figured so prominently in that film, he could not help but smile at the raw crudeness of his own tiny workshop.

No maze of cryptic coils and bars here. No ponderous machinery bedecked with bewildering keys and switches, no spluttering arcs or leaping flares, or glistening tables strewn with fuming beakers of chemicals and mysteriously bubbling test tubes. It was merely a quiet, simple room, with workbench, a desk and—a Chair.

Yet the Chair, Old Cautious knew, was a greater scientific achievement than all the harebrained marvels the movie genius had concocted from his maze of fantastic equipment. Here, at long last, was the seat of knowledge—the student's bench to the unplumbed secrets of mankind. With its help, Bradner meant to embark on the greatest quest man could conceive—the search of the secret of being.

Bradner chuckled once again and settled himself in the Chair. Under the fingers of his left hand were a series of buttons controlling the complicated

mechanism beneath the seat. The fingers of his right hand touched a vernier which could advance, retard, or even halt his rush into the unknown. In the pockets of his loose jacket were notebook and pencils, about his waist an unaccustomed gun belt. It was unlikely that he should find use for these things where he was going, but Bradner had earned the name of Old Cautious. It was best to leave nothing to chance.

On the desk across the room lay his diary; in it was a complete summary of his investigations, as well as a detailed description of the Chair. A card attached to the book instructed his landlady to forward it, should he not return within a reasonable length of time, to Professor Hallard Grayson of the university. Grayson, of all his colleagues, was most likely to understand the abstract reason that underlay the computations in that book. Grayson, too, was blessed with those priceless gifts: imagination and a sense of humor.

"WE LIVE," Bradner had written in the diary, "in a world of three dimensions. Length, breadth and height are the terms commonly used to describe these three. Theorists have promulgated a fourth—a *time*—dimension, but of this we have no assured knowledge save that time is.

"It is a general premise that each dimension is an extension of former dimensions. This is, in a sense, true. A line is an extension of a point—a



The flashing scenes paused, slowed, and became rational. Amazedly, Bradner watched, as before him, or through him, the flux of time moved.

square the angular extension of a line—a cube the right-angled extension of a square. A tesseract, thus, is the logical fourth-dimensional extension of a cube.

"I hold, however, that succeeding dimensions not only extend, but *bound*, former dimensions. This fact, evident upon thought, is too generally overlooked.

"From a *punctus*, a point, lines might radiate in infinite variety. A point projected into its first, or linear dimension, however, becomes a line extending infinitely into only *one* direction. Thus the point has been, at the same time, extended and bounded!

"Similarly, a line may conceivably be extended into an infinite number of planes—but when actually extended into one, it becomes bounded by its dimensional extensor. It becomes a plane, or unidimensional, figure!

"A plane figure—a square, let us say—when extended is also bounded into a three-dimensional cube. Theoretically, this law obtains through all higher dimensions as well—a fourth-dimensional figure being both extended and bounded by its fourth-dimensional source, and so on.

"This explanation is, I know, superfluous. I include it merely to introduce my invention, and to explain its powers.

"It is my belief that somewhere within that which we know as the unidimensional state—that state wherein exists neither breadth nor height, only extension—lies the secret of the beginnings of life.

"Let us liken man's life to a tridimensional graph of coördinates. At any given space within this graph is the dot—*man*. He is the junction point, the meeting place, of his elemental compositories; portions of which have been bounded, stripped from him, by the coördination of higher dimensions. Man, then, is *not* the complete sum of those things from which he sprung. *He is*

merely the intersecting sections of those three infinities which coördinated to create him! It is my purpose to project, or perhaps *unproject*, myself down through these dimensions, to solve, if possible, the riddle of man's beginnings. This I can do with the aid of my Chair.

"In this diary you will find a complete mechanical analysis of the Chair, with schematics of those parts which require special construction. If, as I expect to, I return from my journey, I shall attempt to bring back with me some sort of factual proof from the *infra*-dimension. If I do not, or cannot, return, I go knowing that this work will be carried on by capable hands.

"And now, my friends and colleagues, *au revoir*. I go, I hope and believe, into the unidimensional source of all knowledge."

BRADNER, sitting in the Chair, shuddered momentarily with a chill of apprehension. Suppose he was wrong? Suppose his calculations were in error, and by some strange chance the Chair twisted him into some queer, distorted oddment of the universe? Suppose—He shook his head slightly, and chuckled again. Such nonsense! Of course he was right! And as for danger—

Impulsively, he dug one hooked finger into a button on the Chair's left arm. A vibration rose from the seat—quivered through his nerves like a jangling, discordant note in music. With his right hand he twisted the vernier.

The vibration increased. The Chair seemed to twist and spin beneath him. A shimmering nebulosity grew before his eyes, and he was whirling, sinking, twisting into a spiral sea of nothingness! The faint humming in his ears rose to a high and piercing scream—long, high, sustained torture! There was a dreadful compression on his body. Darkness gathered before his eyes, writhing darkness curling into impossible forms. Then—silence—

HE WAS a *oneness*, but not a body. All about him was a sliding kaleidoscope of color and movement—real, tangible, but somehow *bounded*. There was a peculiar flatness to his surroundings.

His own body was gone, and with it his organs of sensation. He had no eyes with which to see, no lips to taste, no ears or fingers with which to explore the strange dimension into which he had been reduced. And suddenly Old Cautious realized, with a thrill of triumph, that he *had* been reduced! His intelligence—the entity that was Bradner—had sloughed off the third dimension, and was now in the plane-table land of the second!

A peculiar sentiency substituted for the normal bodily senses. Dimly, Bradner became aware that his *oneness* stretched, infinitely tenuous and bulkless, into a vast, never-ending plane that cross-sectioned eternity from the farthest star to the edges of time itself. Ridded of his third-dimensional boundary, he had become a single infinite plane in existence!

The swirling, chaotic maze of colors and forms about him were, of course, scenes viewed at too-great speed. Bradner discovered that by an effort of will he could control his speed—or, better, the speed of those constants which were in him, of him, and a part of his bi-dimensional, omnipresent self. He concentrated on the task of slowing down the motions that surrounded him, that he might better study a section of them.

The flashing scenes paused, slowed, and became rational. Amazedly, Bradner watched, as, before him, or through him, the flux of time moved. Pictures built up in a cinematic sequence, as his plane moved through time—flat pictures—

Great steaming jungles, riotous with huge, tropical fronds, merged slowly into great cities with towering buildings that mocked the skies. Here a volcanic mountain spewed grisly ash and fiery

death on a blood-red world; near by, a cold-green glacier ground slowly and inexorably across the wincing face of a grim and desolate world. A stiff-winged monster of steel flapped carelessly over a plain of jet marble; burrowing worms, ichorous and blind, gnawed fretfully at the bowels of a star in some far-forgotten universe.

Bradner's mind reeled with the immensity of his vision, and, manlike, his thoughts fled to the tiny planet that had mothered him and his kind—earth. And the thought was a contractile occupation of that infinitesimal portion of the infinity that was himself. Swift as thought, the scene shifted to that tiny globe.

BUT what a world! Not one, but a thousand limitless vistas stretched before him in that one small spot. A world peopled sometimes by man, sometimes by a form of mutable plant life, sometimes dominated by a gigantic form of lizard, a highly intelligent elephant creature with minute tusks and a huge, shining brainpan—once, even, by a silicate form of life that grew in crackling subdivision into a mass of angular tetrahedra and spires.

Most often, however, by man. Yet even when Nature's most successful experiment had become the ruler, there was endless variety. Bradner looked with astounded eyes on a thousand worlds that were, yet were not. Here a mighty Roman civilization ruled proudly over the whole of the terrestrial globe, while on a divergent line of the plane a mighty Spanish empire sent its golden galleons into the far-spread ports of its domain. Carthage, in all its grandeur, formed an enduring pact of peace with a mighty empire of black men from the south; yet near by there was no Carthage and no race of black men—only one vast, wide city alive in a dead world, a city called Bogar, peopled by the blue-eyed, strong-thewed children of the Vikings.

And suddenly Bradner understood!

It was as he had thought. In loosing the bonds of the extending third dimension, he had infinitely widened his scope. *He was seeing the probabilities of life!* The many, many things that *could* have happened to the world, had not single events—seemingly unimportant at the time—determined that one point life was to have reached on the tridimensional graph at the time of Bradner's being!

These plant men, these lizard creatures, this Carthaginian civilization—all *might* have been! They were permutations of that equation which, slowly but inexorably evolving, had turned to life as it is known to-day. On the instant, Bradner realized that every little thing that transpired in the past, was happening now, was to happen in the future, welded another inescapable figure to the equation of existence.

Had not the Spanish Armada been defeated, the world would have reached the civilization Bradner had seen. Had one wee pebble dropped in the flaming crater of a now extinct volcano at some dim, forgotten moment in history, all life save that of the Bogarian Norsemen would have been swept out of being. Chance, and chance alone, had determined that life should choose one of this infinity of possibilities!

Nor were these figures fantasies! They were real—as real as that other life, in the third dimension, that Bradner had formerly known. They existed on the plane surface of the bidimensional state in much the same manner. Old Cautious reasoned, as a man's image exists in the reflecting glass of a mirror. That was it! They *mirrored* life as it was to have been, had the series of coördinates differed!

A curious seething shock Bradner's extended self. On, then! On to yet another dimension—the single dimension bounded by this plane of possibilities! On to the unidimensional state

wherein lay only extension—and the knowledge of all!

Bradner's body was not—but the sentience that dictated him still experienced the *feel* of the Chair, with its control buttons and its vernier. These, too, had become one with the plane of infinite breadth, and the motivation of the Chair's powers were a thought process rather than a tactile one. Ardently, eagerly, Bradner willed himself to experience the change—the sloughing of the dimension of breadth.

THERE WAS a moment of shearing. It was as though Bradner were being slashed, cut with a razor edge of pain, into an emaciatingly thin line that strained and struggled to maintain its identity. Again that high, shrill screaming sounded in his ears, that grinding sense of compression— Then a sudden, singing sound like the laughter of flame, and a vicious, fast—oh, blindingly fast!—release.

There was nothing! About him there was a vast, aching silence that stirred in indefinable depths. Color was gone, and motion; light, heat and impulse were almost forgotten things. The space wherein he was— Bradner's mind quivered with a dazed qualm—there was no space! No space and no matter! Just—nothingness!

For an instant Bradner throbbed with anxiety. It was not what he had expected, this! To slough off still another dimension, to become a single, infinitely extending straight line—yes! To become an uncoördinated line in the graph of existence, stretching endlessly on and on to the farthest barriers of eternity—perhaps even to turn there at infinity with such turning as only the infinite line can know when it meets itself in the beyond—that he had expected! But *this*—

Frantically, he wrestled with the grim secret. It had an answer somewhere! It had to be logical! Yet logic did not

explain this vast, empty, inconceivably silent void of which he had become a part.

There was a seething within him, and sudden color began to coalesce within his own being. Color invisible, but felt because it was of him and a part of him. The color had motion, too, he suddenly perceived—restless, growing, constantly encroaching motion: swift, flaming spirals; nebulae of motion and incomparable speed—expansion of a sort, reaching toward his limitless boundaries. Bradner felt within himself the birth and the end of all being. He was the unit, one and inseparable, of all things and—of nothing!

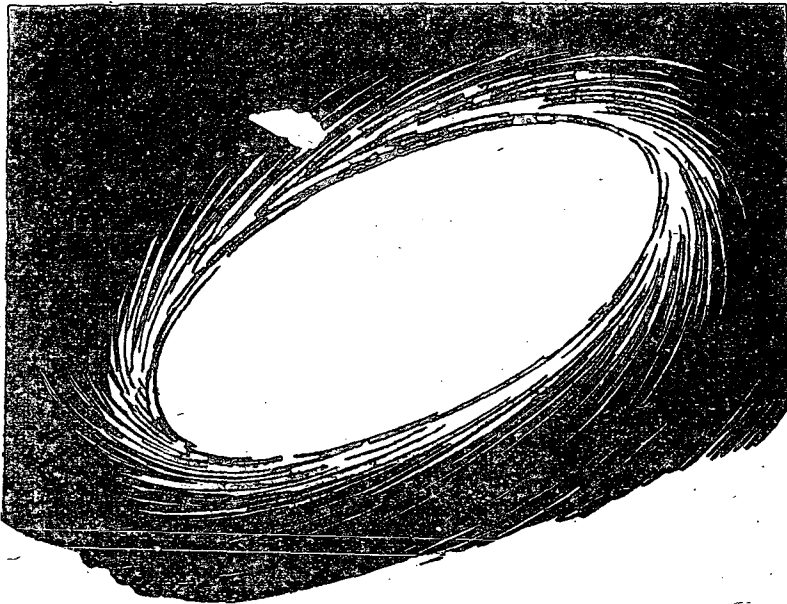
And a swift knowledge broke upon him as a bolt of lightning flashes suddenly upon the tiny world that Bradner had once known. Old Cautious had been wrong! Old Cautious had made an error! He had reached the first dimension—yes! But the first dimension was *time*!

Man, who sought the fourth dimension with eager determination, already

lived in it! And he, Bradner, had cast himself down, down, down through the dimensions, until he was one and a part of time itself! In him all things were—the beginning and the ending. In him fiery nebulae were being born, would ultimately burst and form his own universe, and would see life begin. He *was*—yet he was still to be, and had already been! He was the one who had escaped the limits of his boundaries on the tridimensional graph of life. He was a part of time infinite!

Somewhere within his being was a tiny workshop and a little black diary. At some *punctus* in himself was his corporeal self starting on the journey into himself as he now was. And thus it would be for all eternity—an endless Bradner seeking the secret of himself in the vast, indefinite reaches of time! Unless—

The great gray void seemed to rock lightly with dashing song as Bradner chuckled. Even a scientist known to his fellows as Old Cautious was not without a sense of humor.



A TALKING HILL

A science article on the Great Pyramid.

by Battell Loomis

A "MIRACLE IN STONE" is a book by Reverend Joseph Seiss, of Philadelphia. He drew heavily on the work of an Edinburgh professor named Smyth. It is an interesting book, though some will have to check the tongue over its theological features. I make distinction between genuine religious feeling and theological interpretation, and have no quarrel with the former, which is seldom applied in the writing of books.

"The Great Pyramid" is a 3-vol. work in the preparation of which a clergyman, Davidson, combined with an engineer named Aldersmith. Its engineering parts are apparently meticulously accurate and to me they were enthrallingly interesting. Its theological parts again held me less, though they packed a sufficient punch to launch what is called The Pyramid School of Prophecy, whose many followers seem to have all too little perception of the importance of hypnotism and allied mental faculties in conducting the thought of nonintellectual, unmathematically minded people.

"The Great Pyramid of Jeezeh" is a book by a San Francisco engineer, Louis D. McCarty or McCarthy by name. In a way it is compendious, though only of novel size, and in many ways it was to me the most interesting of the 3 works, which are all I have been able to see touching the subject. This book was privately published about the time of the San Francisco earthquake fire, and is now out of print, unfortunately, for it is worth perpetuating.

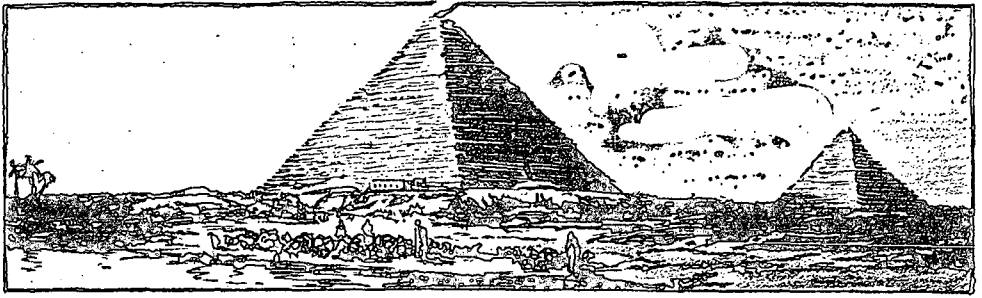
All 3 of these works combine to scoff the archaeological idea that the Great

Pyramid of Giza was ever a royal tomb. McCarthy shows by parallel drawings that no other tomb, or pyramid, was laid out with geometrical accuracy and purpose—all but imitated the grand original and did so in ignorance of its functions.

The reading of these works set alive in me a very active associative whirl of reasoning and conjecture which kept me busy writing it nearly a whole winter, but in this sketch I am not ocularly referring to any of the books nor to any of my put-away manuscripts. My reliance thus being wholly upon memory is assuredly wabbly, and I will proceed to include in what I am putting down fully as many errors as any other writer has made with reference to the wonders of antiquity. Unless there is such a thing as the akashic realm, or the memory of Nature, and unless all men have access to it when they concentrate—its modern names are the sub-conscious and the deep self—there is small chance of any one's imaginatively putting himself in the place of our distant forbears and seeing the world as they saw it—with accuracy.

However, with this preamble, I shall proceed, as systematically as I may, to point out what have been for me the salient features of the first wonder of the world.

The Great Pyramid covers 13 acres—less than half the extent lately held down by the Crystal Palace of London, which covered 28 acres. It stands over 500 feet high, and until the building of the Eiffel tower was the tallest structure on earth. Its base is perfectly square



The Great Pyramid covers 13 acres—less than half the extent lately held down by the Crystal Palace of London.

and perfectly oriented, from corner to corner, but its base line (some 763 feet or so) is not straight. A line from corner to corner finds the center of the north face about one yard behind it. This means that the great triangle was bent inward at the middle, for some purpose. It happens to stand 30° east of Greenwich and at 30° north latitude—where the lines cross. But this point had no meaning in days when Greenwich did not exist, unless such meaning survived in racial memory to secure the establishment of the meridian at Greenwich as central for world navigators.

Hasty estimate might say that the pyramid was a sixth part of a cube, but the addition of its height, to its height, would give a dimension of over 1,000 feet, which would not square with a base line under 800 feet. It would help my argument a lot if it were the exact sixth part of a cube—for then the other 5 such parts, if equispaced about the globe, would be placed the 5,000 miles apart that I find necessary, if the pyramid functioned as a telephone booth, which I think it did. (This is my first fool error. Find it.)

HASTENING over the well-known facts of the structure—such as that it was built of 20-ton blocks of Nummulitic and another type of limestone with inner-wall facings of a red granite, whose quarry has never been found and whose like is not elsewhere known on earth—I

come to the less-known fact that 2 of the missing facing stones were found under the rubble, at the point of the dish in the north wall, whose unmarred, highly polished surfaces supplied the angles necessary for a reconstruction of the exterior angles.

The pyramid was not only a sundial—it was a beacon. It was not only a beacon—its 4 snow-white faces shining to the quarters of the compass—but the slopes of its north face indicate it as a searchlight—a reflector that concentrated the sun's midsummer-day noon beam and shot it intensely shining straight north across the entire Nile delta (weather conditions permitting). Why? Because surveyors needed the shadows cast by that beam.

The annual or biannual Nile floods effaced, muddled over, all landmarks in the fertile Delta. Midsummer's Day (the Druid's festival) was the time when planting could be begun in Egypt. The shadows cast by the midday beam divided the Delta and the minute marks of the entire day served as lot lines which, of course, ran fanwise from the point at the peak of the Delta, so that farms nearest the sea were of broadest extent (and also less richly silted over by the recent flood, bringer of the land's fertility).

The point of the pyramid was called the *ak* (sometimes nasaed Ank or ANG—our word angle is from it.) *Ak* is a common word throughout the Orient.

In Persian it means earth, where *an* (on high) means heaven, so *khan* means (ak-an) earth-heaven and as *jenghis* means ruler, the supposed name of the Mongol Jenghis Khan is easily interpreted as a mere title—ruler of earth and heaven. Men seldom had individual names in those days, and when they did, they always meant something—usually as titles of prowess. Adam equals red earth. Euclid equals good key (to geometry, understood).

That digression was necessary to what will follow. The point of the pyramid was so placed that it stood directly under the sun at Midsummer Day, noon. *Ak*, nasaled in the Coptic to *ank*, means son (i. e., chip off the old block—angled from a sire). The point was on that day in vertical angle with the sun; it became, figuratively, the “son of the sun,” and religion built upon it.

Theologians understand men, not men's works. Science makes men's works.

Again, the point of the pyramid was its highest part—ac-me (don't forget that “c” is a bastard of “k” and “s” and acme should be spelled ak-me). But culm, comb, (ak-*ulm*, ak-*omb*) and other “ak” words—name highest parts elsewhere—in Maori the *lignum vitae*, which surmounts tall trees, is ak-i, in New Mexico ak-oma is a mesaed city and a holy city, off southwestern Ireland is a 600-foot pyramidal isle called Tearacht (teo-*akt*, god hill) or Divine Height, and height (high) itself preserves the meaningful “ak” sound, especially if respelled hi-*akt*, hi-*akt*. But the top of the pyramid, seen from the north was pe-ak (its peak) and since *pe* means north in Chinese I rest content with my picking over the old word pile. “Ak” is the root of acre, *agoura* was a 10-acre square in Egypt. All palatal sounds interchange under Grimm's Law, and I am satisfied that the pyramid sired surveying. Acre. (*acer*) means field in the dead language, but that is a devel-

oped sense of “ak.” (A playing card, ace, is a field. One of them has a spade in it, too.)

In thus applying theological practices of interpretation to solve from some surviving words the problem of an old science, I do not fool myself. I would not fool others; deduction is a legitimate practice of the wits, but I am less foolhardy than to assert that the Franco-Prussian War began in 1870 because at a certain number of inches along a pyramid corridor a jog occurs in some masonry. Any one can convert inches into years, by renaming the spaces. I am applying myself to old and actual names—words that were in use in the youth of tongues. I have shown “ak” to have been in use all over the world.

How could a knowledge be common all over a world that had only waterways as a means of communication? It is a question open to several reasonable answers. Men's throats and mouths have about the same shape and capabilities everywhere. No man, in any language, who seriously attempts to discover the first sound that could issue from an open mouth will fail to make the first noise of an aspirate. Only “h” can be sounded when air is blown from the throat without vibrating vocal cords—only “h” can be sounded by any animal, even the humble snake. Always, everywhere, in any mouth of beast or man, putting the tongue against the teeth while emitting air will sound an “s.” The snake hisses—“hs”—and words based on this principle will be the same in all tongues. But must their application—which is to say their interpretation—be the same in all tongues? Take *baja*, back and *vach*, sounded almost the same. The Spanish means lower; the English is plainly what it is; and the Sanskrit is voice—not much connection in meaning, hard to see the connection between *vach* and bachelor, till we recall that a *vaquero* is a cowboy (“b” and “v” interchange) and cowboys

are always yelling at cattle—hence the vocal root in bachelor. But *baja* (pronounced “bokhah”), back and *vach* all have that “ak” root in which we can discern a suggestion of the angular or the earthly—the raised or not raised.

There was nothing else on that north face of the pyramid except a 40-inch square hole about 11 feet up from the ground level, but in olden times, when the Arabs stole the beautiful facing stones to burn for their lime and to recut them for building blocks still in use in Mecca and other cities, rubble filled the aperture so that Ali Baba and his forty thieves did not see it when, in the fifth century, a way was blasted into the pyramid, seeking the gold it was thought, as a king's tomb, to contain.

I am not concerned here with the remarkable occurrence that discovered to the Arab despoilers the passage leading down from that hole. If you want the willies in wonder at what man can do by obeying natural law, look the matter up.

LET US NOW take our bearings on the pyramid for the last time before entering it. It is a vast, white triangle, visible for 40 miles on clear, dust-free days. It can be seen as a bright point from the waters of the Mediterranean. Its beam shows that far north.

It is a 4-sided pyramid and as such has 5 corners. In the following you will do well to watch the 5s go by. Men used to count only upon the fingers of their idler left hands—the hand that held the bow, the shield or the chisel, and was, therefore, freer for use as a tally of shots, blows or strokes.

Approached from the north the pyre is seen as a white triangle above a sloping cliff. This slope is composed of the rubble of the local chisel work done on the huge blocks and done so perfectly that there is scarce room for a thin coat of varnish between the faces of adjoining blocks, where they still stand

as they were placed so long ago. The use of a planetarium could determine precisely the century in which those blocks were planned and piled, for that north port is a North-Star port, and, as we know, there never was a truly North Star, and as that passage inclines about 4 degrees west of north, a sight taken along its center would point the spot in the north heavens into which a

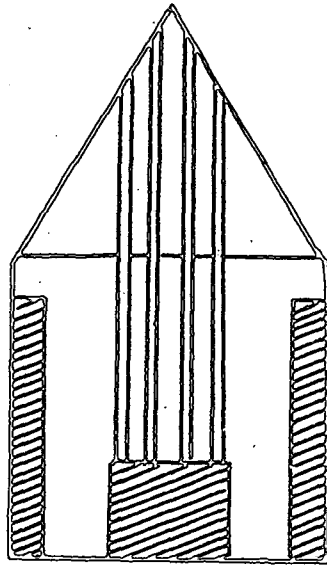


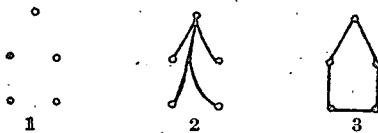
Figure No. 7

planetarium could turn the star the builders aimed to center on that port and passageway.

Now we enter the passage. Look out, it is new, polished like a mirror and slippery. Bare feet are best, unless we like to coast down chutes. The angle of descent is such that, beginning 11 feet up the slope of the surface, it leads to a chamber 100 feet below the ground and not quite under the center of the 13-acre tract on which the pile stands. Down 111 feet and back over 375, approximately a 1 to 3 inclination—would that be a 33 per cent grade; you road builders? Fairly steep for standing on icelike finishes. But never mind that—

the ancients used it to get into the rock chamber they never finished. We can get in that chamber, too. In it, we turn in the pitchy darkness and look back, on a blaze of light if it is day, and on one star, if it is night; but that star will cross the aperture and disappear, for it is not true north. There is no star that is ever stationary as it appears from the earth.

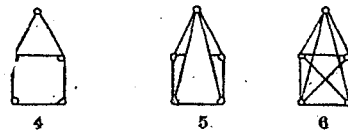
If my memory does not fail me that star is *Thurban* in the Arab cosmogony, but its name means more to us in one of the Mexican tongues which called it *Chaak Maatz*. Etymologists trying to spell foreign sounds often cover up what might prove highly useful to them. I would spell that star *Chock-mats*, because so spelled its name begins to show an English sense. The Mayan astronomers thought they had found a star that did not move. Such a star would be chock-a-block, in our slang. Mats in our tongue would be matted; matted reeds in a river's wash taught men how to weave mats. Mat is the root of matter—hence “the star that was fixed” was named in rough translation “choked matter.” Perhaps the discovery that *Thurban* did move was only made after the passage had been made and the underground hole dug and the chamber partly completed, whereupon the completion of the chamber became fruitless and it was abandoned. But the Greek name of the constellation in which that star hangs is *Cepheus*, and at present that constellation looks like the peaked gable end of a house, here indicated by 5 dots. See cut No. 1.



CAN all these stars be seen from the astronomer's room under the pyramid—the ocular chamber? Or was only the peak star aimed at? The Latin name of *Thurban-Chock-mats* is *Capella*,

meaning “the small head” (*capo*, head; *ella*, the diminutive form). Had this a meaning to the ancients? Can we find it? What would you do in a telephone booth with those 5 dots on a number pad? I'd draw straight lines, connecting the dots. Let's do it now. See cut No. 2. By golly! As I live, a sketch of a man has appeared, and his “little head” star is *Capella*!

Let's see what else there may be in the design of those dots, 5 of them: See cut No. 3. The house of a man—but whoa—Egyptian architecture is ever peculiar in that it contains no peaked roofs, except the pyramids. Maybe it has something to do with a pyramid, a 4-sided one. Let's try: See cut No. 4. A square base line, a triangular face! But, once more, the 5: See cut No. 5. A pyramid outline sketch! But all the couples have not yet been drawn. Do them all, now: See cut No. 6. A star in a frame.



How odd—it is The Seal of Solomon! I always thought there were parts of the Bible that would bear closer inspection. Were the Jews the geometers of Egypt, or were the Egyptians? Did the men under conquest understand the science of their intelligent lords and masters? Moses evidently did, for his name means “measurer” and he “went up into the mountain to copy the tables (*mesæ*) of the law.” Somewhere else it says he received them from the Lord.

It is time to crawl up the ramp to see what we can see. (We can't go upstairs or take an elevator.) We crawl nearly to the aperture—the North-Star port—and then, looking backward and above, we see that another ramp leads upward from the roof of the lower one. We ease up the 40 inches—hip-high—

and crawl until we have passed 5 x 5 courses of masonry from ground level. On the twenty-fifth course, near but not at the center of the pyramid, we enter the strangest construction in all prehistory—a peaked-roofed square room! No peaked roofs anywhere else, not even anywhere else in this great pyramid. *Bomas* of thatch and tents of hide were conical, but not peaked. All stone buildings were roofed with massive flat stones shoved over inward-leaning walls. After the walls had been buttressed with dirt and when the flats were in place, the rooms were excavated from under them.

We face the south and most interesting wall, after entering, and find its outline, or elevation, to be that of the 5 stars having *Capella* as their head. Now, what is a *capella*? A chorus singing without instruments, as in a chapel. What is a *cupela*? The breathing head-piece of a barn. What is the *Kabbala*? Has it any connection with the head of a man; does he who works with numbers use his head? Remember Grimm's Law—b, p, v interchange because people hear incorrectly and use their lips with minor differences in stress.

What then is the chapel, this music room? Is it an audience room? Does anything in it bear out the hint? The south wall does and the east and west walls do and the peaked roof does, and if we are really there in its old days there is a fine gold screen standing before the south doorway. It never had a door; there are no grooves in the rock for hanging anything in place there. But there are grooves over the doorway—4 of them. Isn't that a little disappointing? Why not 5? It is the age of the 5-base—the left-hand tallies.

We measure each erect flute, or groove, cut in the hard, red granite, polished with infinite pains, continuing in the surmounting white limestone, of the same breadth and depth, but in a material of different echoing powers. Limestones are very soft compared with the

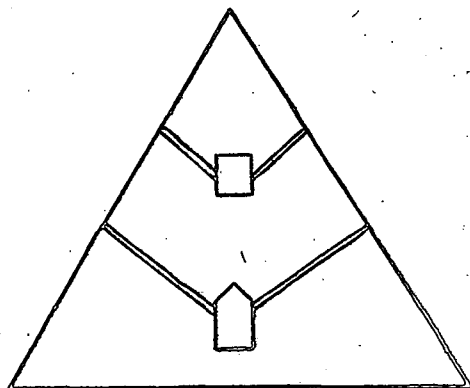


Figure No. 8

tripartite crystallizations of Atlantean red granite. (Atlant sank; this granite is not elsewhere to be found to-day.)

Our measures show that each flute is 5.005 of an English-standard inch wide. The interspaces are also 5.005 inches between the flutes. There are 3 of them. The 4 flutes are environed by 2 blank spaces. Our hand thus shows the spaces between the figures as flutes. But the flutes are not 5.005 inches deep, nor even half of that, as they might be expected to be if they had ever inclosed organ pipes of any sort. They merely suggest organ pipes, standing upright as they do above the black square of the doorway.

Have we learned anything? The pyramid inch must have been 1.001 English inches. Has the English inch contracted from its first and scientific standard? 500,000,000 pyramid inches are said to reach from pole to pole, measuring the vertical diameter of our globe. The same number of English inches fall just 500,000,000 thousands of an English inch short, unless the globe has contracted so much since it was—or may have been—first measured. Since the ancients wrote accurate calendars we may rest content that they did make the necessary measurements and get them right. Man in Nevada, Mexico, Egypt and elsewhere knew time to a T; they were learning measure for the race and

were intimately concerned with measures.

THE FLUTES escaped the 5 taboo, because they had to be shallow for some purpose. I suggest it was an acoustic purpose. Above them was that peaked roof, a reflector as the north face with its inclines was a reflector. No light penetrated to this Capella room; but something did penetrate to it: sound.

On the east and west walls, in the beautiful red granite, are two clumsy holes. They were chiseled theré by an abysmal brute disguised as an archæologist, in the '80s. He was so clumsy with his chisels that he lost one in each hole! His work served to discover the reason why tapping had disclosed 2 hollow places behind the facing stones.

Through the nasty jagged holes he made in the jeweler's fine work he could see that two pipes, 5 inches in diameter, perfectly cylindrical and mirrorlike in high polish, led slanting upward and outward from the room. He could not test them because he had smashed both of the diaphragms with which they brought up with a round turn. The ends of them in the facing stones were bullet-shaped—the point of a bullet. He should be emblazoned as a warning to all archæologists never to break what they cannot possibly repair. But, of course, those broken diaphragms could now be duplicated and set up to test their use.

If there was a gold magnifying screen before the flutes, it was stolen by Aladdin or Ali Baba. The flutes could have served only as channels to lead the faint vibrations to the magnifying device of whatever nature. I, at least, am satisfied that a structure that has an eye at its foot and an ear above the eye, must have a voice somewhere higher up, for it is evident that such a structure symbolizes a skull, with brain pan down. So I will now lead on to find the vocal device.

Sure enough, another ramp leads on upward, across 5 x 5 courses of masonry and at the same angle of grade, until upon that course then thought of as 5 x 5 plus 5 x 5 (because they didn't use 10s to figure with and so had no 50 as a 5 x 10. It was Pythagorus who foresaw that "10 would rule the world") we find the voice of the lord of the mountain. It is a great coffer. This coffer is a standard ton, or a *tun*, by dry or liquid measure for its possible contents. It is of the same primordial red granite and until abused by touristic chippers, who had no eye for its rarely beautiful craftsmanship, its tone when struck was a pure A. What remarkable depth that masonic knowledge had which could carve a given tone from a block of hardest stone! Or did they preconceive it? I like to think those masters of the Stone Age knew more than we do about stone.

This coffer, is, of course, a gong—the father of the African tom-tom, science of telephony, or else the one full-grown son of that primitive science. When empty it sounded A, when a quarter full of water, wine or oil, it sounded the second pentatonic tone; half full, the third tone; three fourths full, the fourth tone and full, the fifth tone. Why? Why does the Orient still use the pentatonic scale while the Occident employs a seven-toned scale?

MY ANSWER can readily have been foreseen. It is that east and west of that loud-speaker there rose two 5-inch tubes that were open into the room from the first. They were shorter than the ear ducts below them in the broader beam of the triangular pile. Sending needs less tube than reception—the vocal cords and throat are short compared to the convolutions of channel that lead to the inner ear.

Should a man shout through a tube from the chamber of counsels and measures would his voice roar down upon

the plain from the heavens? Would ignorant folk thus have heard "the voice of the Lord"? Should the gong tone, would it thunder down on the plain from what Tyndall called the acoustic clouds? Would the vibrations set up carry very far—far enough to be received by another audience room in another pyramid far away? If the world were divided in 5 equal spaces, with a pyramid every 5,000 miles, would 5 pyramids belt the globe with intelligence? Before jumping at conclusions having to do with the limitations of audibility, it should be noted that granite is made of crystals and each crystal may serve as a reflector of minute vibration—a crystal set, indeed.

I am ready to leave the question with you. A belt on the thirtieth parallel would not find land at all of the 5,000-mile points and the circumference could not be evenly divided by measure of 5s. The earth is 25,000 miles in circumference at the equator, but a measure begun on the thirtieth parallel could not proceed east and west for 25,000 miles without serious overlap.

However, 5,000 miles slightly north-east is a Persian town with the suggestive name Mohammerah—it sounds like

hammering—and 5,000 miles farther east, in China, precisely on the parallel, is another batty name—Ba-tang!—which rings like a beaten bell when spoken. Easter Island which had great monuments from antiquity lies southeast from China and is in the southern hemisphere, but Kamchatka is 5,000 miles northeast. Queen Charlotte's Isle, west coast of Canada, is 5,000 miles from Kamchatka and 5,000 southeast of it stand the undiscovered pyramids of Yucatan—perhaps one of them was a "talking hill"?

But my best bet lies westerly from Giza. It is the Azores. They are 5,000 miles west of Giza and 5,000 miles northeast of Yucatan. Their name in Portuguese is probably their primitive name. It is *Ac-ores*. The ore suggests speech—oral, *ora*, and we recognize the "ak" of the earth or hill peak. The *Acores* are a talking point, at least. They were the east-coast range of Atland. Now get out your globes and put your fingers on the pyramids—then go out exploring and find them. When you have found two in working order, let's hear how the ancients used such telephone booths to spread one speech about the earth? Go to it—"hekuvalotuv" fun!

A new novel by the author of "World of Purple Light" appears next month:

OTHER SPACE

by

Warner Van Lorne

Don't Miss the May issue of Astounding

*Science says—and is not science always
right?—that only the great dinosaurs
of the Cretaceous age left their fossil
footprints in the*

SANDS of TIME

by P. Schuyler Miller

A LONG SHADOW fell across the ledge. I laid down the curved blade with which I was chipping at the soft sandstone, and squinted up into the glare of the afternoon sun. A man was sitting on the edge of the pit, his legs dangling over the side. He raised a hand in salutation.

"Hi!"

He hunched forward to jump. My shout stopped him.

"Look out! You'll smash them!"

He peered down at me, considering the matter. He had no hat, and the sun made a halo of his blond, curly hair.

"They're fossils, aren't they?" he objected. "Fossils I've seen were stone, and stone is hard. What do you mean—I'll smash 'em?"

"I mean what I said. This sandstone is soft and the bones in it are softer. Also, they're old. Digging out dinosaurs is no pick-and-shovel job nowadays."

"Um-m-m." He rubbed his nose thoughtfully. "How old would you say they were?"

I got wearily to my feet and began to slap the dust out of my breeches. Evidently I was in for another siege of questions. He might be a reporter, or he might be any one of the twenty-odd farmers in the surrounding section. It

would make a difference what I told him.

"Come on down here where we can talk," I invited. "We'll be more comfortable. There's a trail about a hundred yards up the draw."

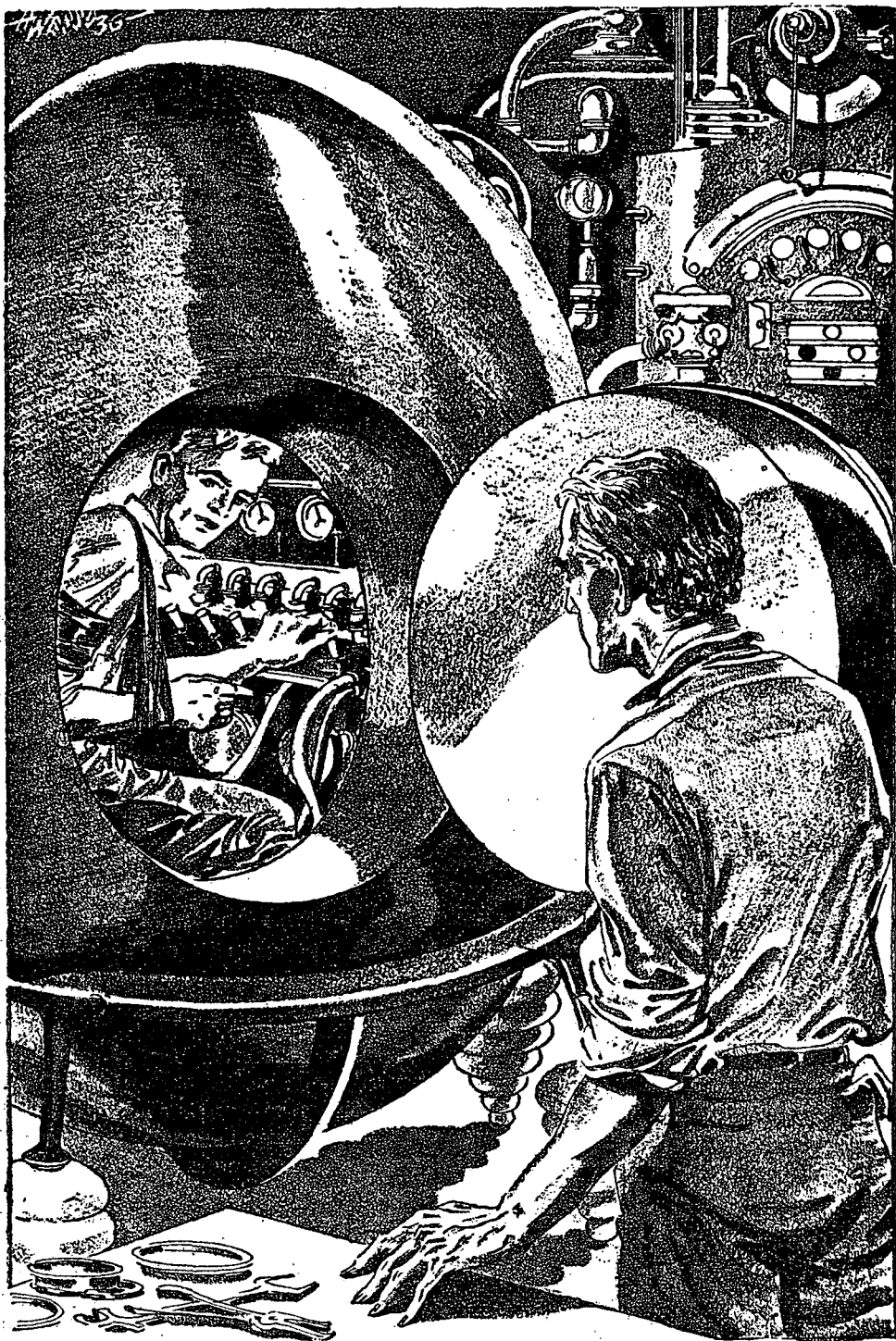
"I'm all right." He leaned back on braced arms. "What is it? What did it look like?"

I know when I'm beaten. I leaned against the wall of the quarry, out of the sun, and began to fill my pipe. I waved the packet of tobacco courteously at him, but he shook his head.

"Thanks. Cigarette." He lighted one. "You're Professor Belden, aren't you? E. J. Belden. 'E' stands for Ephratah, or some such. Doesn't affect your digging any, though." He exhaled a cloud of smoke. "What's that thing you were using?"

I held it up. "It's a special knife for working out bones like these. The museum's model. When I was your age we used butcher knives and railroad spikes—anything we could get our hands on. There weren't any railroads out here then."

He nodded. "I know. My father dug for 'em. Hobby of his, for a while. Changed over to stamps when he lost his leg." Then, with an air of changing the subject, "That thing you're digging out—what did it look like? Alive, I mean."



"I'll send her back in the Egg," he said. "I'll show you how to charge it—and when it's ready you will send it back, empty, to me."

I HAD about half of the skeleton worked out. I traced its outline for him with the knife. "There's the skull; there's the neck and spine, and what's left of the tail; this was its left foreleg. You can see the remains of the crest along the top of the skull, and the flat snout like a duck's beak. It's one of many species of trachodon—the duck-billed aquatic dinosaurs. They fed along the shore lines, on water plants and general browse, and some of them were bogged down and drowned."

"I get it. Big bruiser—little front legs and husky hind ones, with a tail like a kangaroo. Sat on it when he got tired. Fin on his head like a fish, and a face like a duck. Did he have scales?"

"I doubt it," I told him. "More likely warts like a toad, or armor plates like an alligator. We've found skin impressions of some of this one's cousins, south of here, and that's what they were like."

He nodded again—that all-knowing nod that gets my eternal goat. He fumbled inside his coat and brought out a little leather folder or wallet, and leafed through its contents. He leaned forward and something white came scaling down at my feet.

"Like that?" he asked.

I picked it up. It was a photograph, enlarged from a miniature-camera shot. It showed the edge of a reedy lake or river, with a narrow, sandy strip of beach and a background of feathery foliage that looked like tree ferns. Thigh-deep in the water, lush lily stalks trailing from its flat jaws, stood a replica of the creature whose skeleton was embedded in the rock at my feet—a trachodon. It was a perfect likeness—the heavy, frilled crest, the glistening skin with its uneven patches of dark tubercles, the small, webbed forepaws on skinny arms.

"Nice job," I admitted. "Is it one of Knight's new ones?"

"Knight?" He seemed puzzled. "Oh

—the Museum of Natural History. No—I made it myself."

"You're to be congratulated," I assured him. "I don't know when I've seen a nicer model. What's it for—the movies?"

"Movies?" He sounded exasperated. "I'm not making movies. I made the picture—the photograph. Took it myself—here—or pretty close to here. The thing was alive, and is still for all I know. It chased me."

That was the last straw. "See here," I said, "if you're trying to talk me into backing some crazy publicity stunt, you can guess again. I wasn't born yesterday, and I cut my teeth on a lot harder and straighter science than your crazy newspaper syndicates dish out. I worked these beds before you were born, or your father, either, and there were no trachodons wandering around chasing smart photographers with the d. t.s., and no lakes or tree ferns for 'em to wander in. If you're after a testimonial for some one's models of Cretaceous fauna, say so. That is an excellent piece of work, and if you're responsible you have every right to be proud of it. Only stop this blither about photographing dinosaurs that have been fossils for sixty million years."

The fellow was stubborn. "It's no hoax," he insisted doggedly. "There's no newspaper involved and I'm not peddling dolls. I took that photograph. Your trachodon chased me and I ran. And I have more of the same to prove it! Here."

The folder landed with a thump at my feet. It was crammed with prints like the first—enlargements of Leica negatives—and for sheer realism I have never seen anything like them.

"I had thirty shots," he told me. "I used 'em all, and they were all beauties. And I can do it again!"

THOSE PRINTS! I can see them now: landscapes that vanished from

this planet millions of years before the first furry tree shrew scurried among the branches of the first temperate forests, and became the ancestor of mankind; monsters whose buried bones and fossil footprints are the only mementoes of a race of giants vaster than any other creatures that ever walked the earth; there were more of the trachodons—a whole herd of them, it seemed, browsing along the shore of a lake or large river, and they had that individuality that marks the work of the true artist; they were Corythosaurs, like the one I was working on—one of the better-known genera of the great family of Trachodons. But the man who had restored them had used his imagination to show details of markings and fleshy structure that I was sure had never been shown by any recorded fossils.

Nor was that all. There were close-ups of plants—trees and low bushes—that were masterpieces of minute detail, even to the point of showing withered fronds, and the insects that walked and stalked and crawled over them. There were vistas of rank marshland scummed over with stringy algæ and lush with tall grasses and taller reeds, among which saurian giants wallowed. There were two or three other varieties of trachodon that I could see, and a few smaller dinosaurs, with a massive bulk in what passed for the distance that might have been a Brontosaurus hang-over from the Jurassic of a few million years before. I pointed to it.

"You slipped up there," I said. "We've found no traces of that creature so late in the Age of Reptiles. It's a very common mistake; every fantastic novelist makes it when he tries to write a time-traveling story. Tyrannosaurus eats Brontosaurus and is then gored to death by Triceratops. The trouble with it is that it couldn't happen."

The boy ground his cigarette butt into the sand. "I don't know about that,"

he said. "It was there—I photographed it—and that's all there was to it. Tyrannosaurus I didn't see—and I'm not sorry. I've read those yarns you're so supercilious about. Good stuff—they arouse your curiosity and make you think. Triceratops—if he's the chunky devil with three big horns sticking out of his head and snout—I got in profusion. You haven't come to him yet. Go down about three more."

I humored him. Sure enough, there was a vast expanse of low, rolling plains with some lumpy hills in the distance. The thing was planned very poorly—any student would have laid it out looking toward the typical Cretaceous forest, rather than away from it—but it had the same startling naturalness that the others had. And there were indeed Triceratops in plenty—a hundred or more, grazing stolidly in little family groups of three or four, on a rank prairie grass that grew in great tufts from the sandy soil.

I guffawed. "Who told you that was right?" I demanded. "Your stuff is good—the best I've ever seen—but it is careless slips like that that spoil everything for the real scientist. Reptiles never herd, and dinosaurs were nothing but overgrown reptiles. Go on—take your pictures to some one who has the time to be amused. I don't find them funny or even interesting."

I stuffed them into the folder and tossed it to him. He made no attempt to catch it. For a moment he sat staring down at me, then in a shower of sand he was beside me. One hob-nailed boot gouged viciously across the femur of my dinosaur and the other crashed down among its brittle ribs. I felt the blood go out of my face with anger, then come rushing back. If I had been twenty years younger I would have knocked him off his feet and dared him to come back for more. But he was as red as I.

"Damn it," he cried, "no bald-headed

old fuzzy-wuzzy is going to call me a liar twice! You may know a lot about dead bones, but your education with regard to living things has been sadly neglected. So reptiles never herd? What about alligators? What about the Galapagos iguanas? What about snakes? Bah—you can't see any farther than your own nose and never will! When I show you photographs of living dinosaurs, taken with this very camera twenty-four hours ago, not more than three or four miles from where we're standing—well, it's high time you scrap your hide-bound, bone-dry theories and listen to a branch of science that's real and living, and always will be. *I photographed those dinosaurs!* I can do it again—any time I like. I *will* do it."

HE STOPPED for breath. I simply looked at him. It's the best way, when some crank gets violent. He colored and grinned sheepishly, then picked up the wallet from where it had fallen at the base of the quarry cut. There was an inner compartment with a covering flap which I had not touched. He rummaged in it with a finger and thumb and brought out a scrap of leathery-looking stuff, porous and coated with a kind of shiny, dried mucous.

"Put a name to it," he demanded.

I turned it over in my palm and examined it carefully. It was a bit of eggshell—undoubtedly a reptilian egg, and a rather large one—but I could tell nothing more.

"It might be an alligator or crocodile egg, or it might have been laid by one of the large oviparous snakes," I told him. "That would depend on where you found it. I suppose that you will claim that it is a dinosaur egg—a *fresh* egg."

"I claim nothing," he retorted. "That's for you to say. You're the expert on dinosaurs, not I. But if you don't like that—what about this?"

He had on a hunting jacket and corduroy breeches like mine. From the big side pocket he drew two eggs about the length of my palm—misshapen and gray-white in color, with that leathery texture so characteristic of reptile eggs. He held them up between himself and the sun.

"This one's fresh," he said. "The sand was still moist around the nest. This other is from the place where I got the shell. There's something in it. If you want to, you can open it."

I took it. It was heavy and somewhat discolored at the larger end, where something had pierced the shell. As he had said, there was evidently something inside. I hesitated. I felt that I would be losing face if I took him at his word to open it. And yet—

I squatted down and, laying the egg on a block of sandstone beside the weird, crested skull of the Corythosaur, I ripped its leathery shell from end to end.

The stench nearly felled me. The inside was a mass of greenish-yellow matter such as only a very long-dead egg can create. The embryo was well advanced, and as I poked around in the noisome mess it began to take definite form. I dropped the knife and with my fingers wiped away the last of the putrid ooze from the twisted, jellylike thing that remained. I rose slowly to my feet and looked him squarely in the eye.

"Where did you get that egg?"

He smiled—that maddening, slow smile. "I told you," he said. "I found it over there, a mile or so, beyond the belt of jungle that fringes the marshes. There were dozens of them—mounds like those that turtles make, in the warm sand. I opened two. One was fresh; the other was full of broken shells—and this." He eyed me quizzically. "And what does the great Professor Belden make of it?"

What he said had given me an idea. "Turtles," I mused aloud. "It could

be a turtle—some rare species—maybe a mutation or freak that never developed far enough to really take shape. It must be!”

He sounded weary. “Yes,” he said flatly, “it could be a turtle. It isn’t but that doesn’t matter to you. Those photographs could be fakes, and none-too-clever fakes at that. They show things that couldn’t happen—that your damned dry-bone science says are wrong. All right—you’ve got me. It’s your round. But I’m coming back, and I’m going to bring proof that will convince you and every other stiff-necked old fuzz-buzz in the world that I, Terence Michael Aloysius Donovan, have stepped over the traces into the middle of the Cretaceous era and lived there, comfortably and happily, *sixty million years before I was born!*”

He walked away. I heard his footsteps receding up the draw, and the rattle of small stones as he climbed to the level of the prairie. I stood staring down at the greenish mess that was frying in the hot sun on the bright-red sandstone. It *could* have been a turtle, malformed in the embryo so that its carapace formed a sort of rudimentary, flaring shield behind the beaked skull. Or it could be—something else.

If it was that something, all the sanity and logic had gone out of the world, and a boy’s mad, pseudoscientific dream became a reality that could not possibly be real. Paradox within paradox—contradiction upon contradiction. I gathered up my tools and started back for camp.

II.

DURING THE DAYS that followed we worked out the skeleton of the Corythosaur and swathed it in plaster-soaked burlap for its long journey by wagon, truck and train back to the museum. I had perhaps a week left to use as I saw fit. But somehow, try as I would, I could not forget the young,

blond figure of Terry Donovan, and the two strange eggs that he had pulled out of his pocket.

About a mile up the draw from our camp I found the remains of what had been a beach in Cretaceous times. Where it had not weathered away, every ripple mark and worm burrow was intact. There were tracks—remarkably fine ones—of which any museum would be proud. Dinosaurs, big and little, had come this way, millions of years ago, and left the mark of their passing in the moist sand, to be buried and preserved to arouse the apish curiosity of a race whose tiny, hairy ancestors were still scrambling about on all fours.

Beyond the beach had been marshes and a quicksand. Crumbling white bones protruded from the stone in incalculable profusion, massed and jumbled into a tangle that would require years of careful study to unravel. I stood with a bit of crumbling bone in my hand, staring at the mottled rock. A step sounded on the talus below me. It was Donovan.

Some of the cocksure exuberance had gone out of him. He was thinner, and his face was covered with a stubby growth of beard. He wore shorts and a tattered shirt, and his left arm was strapped to his side with bands of some gleaming metallic cloth. Dangling from the fingers of his good hand was the strangest bird I have ever seen.

He flung it down at my feet. It was purplish-black with a naked red head and wattled neck. Its tail was feathered as a sumac is leafed, with stubby feathers sprouting in pairs from a naked, ratty shaft. Its wings had little three-fingered hands at the joints. And its head was long and narrow, like a lizard’s snout, with great, round, lidless eyes and a mouthful of tiny yellow teeth.

I looked from the bird to him. There was no smile on his lips now. He was staring at the footprints of the rock.

“So you’ve found the beach.” His

voice was a weary monotone. "It was a sort of sandy spit, between the marshes and the sea, where they came to feed and be fed on. Dog eat dog. Sometimes they would blunder into the quicksands and flounder and bleat until they drowned. You see—I was there. That bird was there—alive when those dead, crumbling bones were alive—not only in the same geological age but in the same year, the same month—the *same day!* You've got proof now—proof that you can't talk away! Examine it. Cut it up. Do anything you want with it. But by the powers, this time you've *got* to believe me! This time you've got to help!"

I stooped and picked the thing up by its long, scaly legs. No bird like it had lived, or could have lived on this planet for millions of years. I thought of those thirty photographs of the incredible—of the eggs he had had, one of them fresh, one with an embryo that might, conceivably, have been an unknown genus of turtle.

"All right," I said. "I'll come. What do you want?"

HE LIVED three miles away across the open prairie. The house was a modernistic metal box set among towering cottonwoods at the edge of a small reservoir. A power house at the dam furnished light and electricity—all that he needed to bring civilized comfort out of the desert.

One wing of the house was windowless and sheer-walled, with blower vents at intervals on the sloping roof. A laboratory, I guessed. Donovan unlocked a steel door in the wall and pushed it open. I stepped past him into the room.

It was bare. A flat-topped desk stood in the corner near the main house, with a shelf of books over it. A big switchboard covered the opposite wall, flanked by two huge D. C. generators. There were cupboards and a long worktable

littered with small apparatus. But a good half of the room was empty save for the machine that squatted in the middle of the concrete floor.

It was like a round, lead egg, ten feet high and half as broad. It was set in a cradle of steel girders, raised on massive insulators. Part of it stood open like a door, revealing the inside—a chamber barely large enough to hold a man, with a host of dials and switches set in an insulated panel in the leaden wall, and a flat bakelite floor. Heavy cables came out of that floor to the instrument board, and two huge, copper bus bars were clamped to the steel base. The laboratory was filled with the drone of the generators, charging some hidden battery, and there was a faint tang of ozone in the air.

Donovan shut and locked the door. "That's the Egg," he said. "I'll show it to you later, after you've heard me out. Will you help me with this arm of mine, first?"

I cut the shirt away and unwrapped the metallic gauze that held the arm tight against his body. Both bones of the forearm were splintered and the flesh gashed as though by jagged knives. The wound had been cleaned, and treated with some bright-green antiseptic whose odor I did not recognize. The bleeding had stopped, and there was none of the inflammation that I should have expected.

He answered my unspoken question. "She fixed it up—Lana. One of your little playmates—the kind I didn't see the first time—wanted to eat me." He was rummaging in the bottom drawer of the desk. "There's no clean cloth here," he said. "I haven't time to look in the house. You'll have to use that again."

"Look here," I protested, "you can't let a wound like that go untreated. It's serious. You must have a doctor."

He shook his head. "No time. It would take a doctor two hours to get

out here from town. He'd need another hour, or more, to fool around with me. In just forty minutes my accumulators will be charged to capacity, and in forty-one I'll be gone—back there. Make a couple of splints out of that orange crate in the corner and tie me up again. It'll do—for as long as I'll be needing it."

I SPLIT the thin boards and made splints, made sure that the bones were set properly and bound them tightly with the strange, silvery cloth, then lopped the loose ends in a sling around his neck. I went into the house to get him clean clothes. When I returned he was stripped, scrubbing himself at the laboratory sink. I helped him clamber into underwear, a shirt and breeches, pull on high-top shoes. I plugged in an electric razor and sat watching him as he ran it over his angular jaw.

He was grinning now. "You're all right, professor," he told me. "Not a question out of you, and I'll bet you've been on edge all the while. Well—I'll tell you everything. Then you can take it or leave it.

"Look there on the bench behind you—that coiled spring. It's a helix—a spiral made up of two-dimensional cross sections twisted in a third dimension. If you make two marks on it, you can go from one to the other by traveling along the spring, round and round, for about six inches. Or you can cut across from one spiral to the next. Suppose your two marks come right together—so. They're two inches apart, along the spring—and no distance at all if you cut across.

"So much for that. You know Einstein's picture of the universe—space and time tied up together in some kind of four-dimensional continuum that's warped and bent in all sorts of weird ways by the presence of matter. Maybe closed and maybe not. Maybe expanding like a balloon and maybe shrinking

like a melting hailstone. Well—I know what that shape is. I've proved it. It's spiraled like that spring—spiraled in time!

"See what that means? Look—I'll show you. This first scratch, here on the spring, is to-day—now. Here will be to-morrow, a little farther along the wire. Here's next year. And here is some still later time, one full turn of the coil away, directly above the first mark.

"Now watch. I can go from to-day to to-morrow—to next year—like this by traveling with time along the spring. That's what the world is doing. Only by the laws of physics—entropy and all that—there's no going back. It's one-way traffic. And you can't get ahead any faster than time wants to take you. That's *if you follow the spring*. But you can cut across!

"Look—here are the two marks I just made, now and two years from now. They're two inches apart, along the coiled wire, but when you compress the spring they are together—nothing between them but the surface of the two coils. You can stretch a bridge across from one to the other, so to speak, and walk across—into a time two years from now. Or you can go the other way, two years into the past.

"That's all there is to it. Time is coiled like a spring. Some other age in earth's history lies next to ours, separated only by an intangible boundary, a focus of forces that keeps us from seeing into it and falling into it. Past time—present time—future time, side by side. Only it's not two years, or three, or a hundred. It's sixty million years from now to then, the long way around!

"I said you could get from one coil of time to the next one if you built a bridge across. I built that bridge—the Egg. I set up a field of forces in it—no matter how—that dissolve the invisible barrier between our time and the

next. I give it an electromagnetic shove that sends it in the right direction, forward or back. And I land sixty million years in the past, in the age of dinosaurs."

He paused, as if to give me a chance to challenge him. I didn't try. I am no physicist, and if it was as he said—if time was really a spiral, with adjacent coils lying side by side, and if his leaden Egg could bridge the gap between—then the pictures and the eggs and the bird were possible things. And they were more than possible. I had seen them.

"You can see that the usual paradoxes don't come in at all," Donovan went on. "About killing your grandfather, and being two places at once—that kind of thing. The time screw has a sixty-million-year pitch. You can slide from coil to coil, sixty million years at a time, but you can't cover any shorter distance without living it. If I go back or ahead sixty million years, and live there four days, I'll get back here next Tuesday, four days from now. As for going ahead and learning all the scientific wonders of the future, then coming back to change the destiny of humanity, sixty million years is a long time. I doubt that there'll be anything human living then. And if there is—if I do learn their secrets and come back—it will be because their future civilization was built on the fact that I did so. Screw it as it sounds, that's how it is."

HE STOPPED and sat staring at the dull-gray mass of the Egg. He was looking back sixty million years, into an age when giant dinosaurs ruled the earth. He was watching herds of Triceratops grazing on the Cretaceous prairie—seeing unsuspected survivors of the genus that produced Brontosaurus and his kin, wallowing in some protected swamp—seeing rat-tailed, purple-black Archaeopteryx squawking in the tree ferns. And he was seeing more! "I'll tell you the whole story," he

said. "You can believe it or not, as you like. Then I'll go back. After that—well, maybe you'll write the end, and maybe not. Sixty million years is a long time!"

He told me: how he hit on his theory of spiraled time; how he monkeyed around with the mathematics of the thing until it hung together—built little models of machines that swooped into nothingness and disappeared; how he made the Egg, big enough to hold a man, yet not too big for his generators to provide the power to lift it and him across the boundary between the coils of time—and back again; how he stepped out of the close, cramped chamber of the Egg into a world of steaming swamps and desert plains, sixty million years before mankind!

That was when he took the pictures. It was when the Corythosaurus chased him, bleating and bellowing like a monster cow, when he disturbed its feeding. He lost it among the tree ferns, and wandered warily through the bizarre, luxurious jungle, batting at great mosquitoes the size of horse flies and ducking when giant dragon flies zoomed down and seized them in mid-air. He watched a small hornless dinosaur scratch a hole in the warm sand at the edge of the jungle and ponderously lay a clutch of twenty eggs. When she had waddled away, he took one—the fresh one he had showed me—and scratched out another from a nest that had already hatched. He had photographs—he had specimens—and the sun was getting low. Some of the noises from the salt marshes along the seashore were not very reassuring. So he came back. And I laughed at him and his proofs, and called him a crazy fake!

He went back. He had a rifle along this time—a huge thing that his father had used on elephants in Africa. I don't know what he expected to do with it. Shoot a Triceratops, maybe—since I wouldn't accept his photographs—and

back off its ungainly, three-horned head for a trophy. He could never have brought it back, of course, because it was a tight enough squeeze as it was to get himself and the big rifle into the Egg. He had food and water in a pack—he didn't much like the look of the water that he had found "over there"—and he was in a mood to stay until he found something that I and every one like me would have to accept.

Inland, the ground rose to a range of low hills along the horizon. Back there, he reasoned, there would be creatures a little smaller than the things he had seen buoying up their massive hulks in the sea and marshes. So, shutting the door of the Egg and heaping cycad fronds over it to hide it from inquisitive dinosaurs, he set out across the plain toward the west.

The Triceratops herds paid not the slightest attention to him. He doubted that they could see him unless he came very close, and then they ignored him. They were herbivorous, and anything his size could not be an enemy. Only once, when he practically fell over a tiny, eight-foot calf napping in the tall grass, did one of the old ones emit a snuffling, hissing roar and come trotting toward him with its three sharp spikes lowered and its little eyes red.

There were many small dinosaurs, light and fleet of foot, that were not so unconcerned with his passage. Some of them were big enough to make him feel distinctly uneasy, and he fired his first shot in self-defense when a creature the size of an ostrich leaned forward and came streaking at him with obviously malicious intent. He blew its head off at twenty paces, and had to duck the body that came clawing and scampering after him. It blundered on in a straight line, and when it finally collapsed he cooked and ate it over a fire of dead grass. It tasted like iguana, he said, and added that iguana tasted a lot like chicken.

Finally, he found a stream running down from the hills and took to its bed for greater safety. It was dry, but in the baked mud were the tracks of things that he hadn't seen and didn't want to see. He guessed, from my description, that they had been made by Tyrannosaurus or something equally big and dangerous.

INCIDENTALLY, I have forgotten the most important thing of all. Remember that Donovan's dominating idea was to prove to me, and to the world, that he had been in the Cretaceous and hobnobbed with its flora and fauna. He was a physicist by inclination, and had the physicist's flair for ingenious proofs. Before leaving, he loaded a lead cube with three quartz quills of pure radium chloride that he had been using in a previous experiment, and locked the whole thing up in a steel box. He had money to burn, and besides, he expected to get them back.

The first thing he did when he stepped out of the Egg on that fateful second trip was to dig a deep hole in the packed sand of the beach, well above high tide, and bury the box. He had seen the fossil tracks and ripple marks in the sandstone near his house, and guessed rightly enough that they dated from some time near the age to which he had penetrated. If I, or some one equally trustworthy, were to dig that box up one time coil later, he would not only have produced some very pretty proof that he had traveled in time—his name and the date were inside the cube—but an analysis of the radium, and an estimate of how much of it had turned into lead, would show how many years had elapsed since he buried it. In one fell swoop he would prove his claim, and give the world two very fundamental bits of scientific information: an exact date for the Cretaceous period, and the "distance" between successive coils in the spiral of time.

The stream bed finally petered out in a gully choked with boulders. The terrain was utterly arid and desolate, and he began to think that he had better turn back. There was nothing living to be seen, except for some small mammals like brown mice that got into his pack the first night and ate the bread he was carrying. He pegged a rock at them, but they vanished among the boulders, and an elephant gun was no good for anything their size. He wished he had a mousetrap. Mice were something that he could take back in his pocket.

III.

THE MORNING of the second day some birds flew by overhead. They were different from the one he killed later—more like sea gulls—and he got the idea that beyond the hills, in the direction they were flying, there would be either more wooded lowlands or an arm of the sea. As it turned out, he was right.

The hills were the summit of a ridge like the spine of Italy, jutting south into the Cretaceous sea. The sea had been higher once, covering the sandy waste where the Triceratops herds now browsed, and there was a long line of eroded limestone cliffs, full of the black holes of wave-worn caves. From their base he looked back over the desert plain with its fringe of jungle along the shore of the sea. Something was swimming in schools, far out toward the horizon—something as big as whales, he thought—but he had forgotten to bring glasses and he could not tell what they were. He set about finding a way to climb the escarpment.

Right there was where he made his first big mistake. He might have known that what goes up has to come down again on the other side. The smart thing to do would have been to follow the line of the cliffs until he got into the other valley, or whatever lay beyond. In-

stead, he slung his gun around his neck and climbed.

The summit of the cliffs was a plateau, hollowed out by centuries of erosion into a basin full of gaudy spires of rock with the green stain of vegetation around their bases. There was evidently water and there might be animals that he could photograph or kill. Anything he found up here, he decided, would be pretty small.

He had forgotten the caves. They were high-arched, wave-eaten tunnels that extended far back into the cliffs, and from the lay of the land it was probable that they opened on the inside as well. Besides, whatever had lived on the plateau when it was at sea level had presumably been raised with it and might still be in residence. Whether it had wandered in from outside, or belonged there, it might be hungry—very hungry. It was.

There was a hiss that raised the short hair all along his spine. The mice that he had shied rocks at had heard such hisses and passed the fear of them down to their descendants, who eventually became his remote ancestors. And they had cause for fear! The thing that lurched out of the rocky maze, while it didn't top him by more than six feet and had teeth that were only eight inches long, was big enough to swallow him in three quick gulps, gun and all.

He ran. He ran like a rabbit. He doubled into crannies that the thing couldn't cram into and scrambled up spires of crumbling rock that a monkey would have found difficult, but it knew short cuts and it was downwind from him, and it thundered along behind with very few yards to spare. Suddenly he popped out of a long, winding corridor onto a bare ledge with a sheer drop to a steaming, stinking morass alive with things like crocodiles, only bigger. At the cliff's edge the thing was waiting for him.

One leap and it was between him and

the crevice. He backed toward the cliff, raising his rifle slowly. It sat watching him for a moment, then raised its massive tail, teetered forward on its huge hind legs, and came running at him with its tiny foreclaws pumping like a sprinter's fists.

He threw up the gun and fired. The bullet plowed into its throat and a jet of smoking blood sprayed him as its groping claws knocked the rifle from his grasp. Its hideous jaws closed on his upflung left arm, grinding the bones until he screamed. It jerked him up, dangling by his broken arm, ten feet in the air; then the idea of death hit it and it rolled over and lay twitching on the blood-soaked rock. Its jaws sagged open, and with what strength he had left Donovan dragged himself out of range of its jerking claws. He pulled himself up with his back against a rock, and stared into the face of a second monster!

This was the one that had trailed him. The thing that had actually tasted him was a competitor. It came striding out of the shadowy gorge, the sun playing on its bronzed armor, and stopped to sniff at the thing Donovan had killed. It rolled the huge carcass over and tore out the belly, then straightened up with great gouts of bloody flesh dribbling from its jaws, and looked Donovan in the eye. Inch by inch, he tried to wedge himself into the crack between the boulders against which he lay. Then it stepped over its deceased relative and towered above him. Its grinning mask swooped down and its foul breath was in his face.

Then it was gone!

It wasn't a dream. There were the rocks—there was the carcass of the other beast—but it was gone! Vanished! In its place a wisp of bluish vapor was dissipating slowly in the sunlight. Vapor—and a voice! A woman's voice, in an unknown tongue.

She stood at the edge of the rocks. She was as tall as he, with very white skin and very black hair, dressed in shining metal cloth that was wound around her like bandage, leaving her arms and one white leg free. She was made like a woman and she spoke like a woman, in a voice that thrilled him in spite of the sickening pain in his arm. She had a little black cylinder in her hand, with a narrowed muzzle and a grip for her fingers, and she was pointing it at him. She spoke again, imperiously, questioning him. He grinned, tried to drag himself to his feet, and passed out cold.

IT WAS two days before he came to. He figured that out later. It was night. He was in a tent somewhere near the sea, for he could hear it pounding on hard-packed sands. Above its roar there were other noises of the night; mutterings and rumblings of great reptiles, very far away, and now and then a hissing scream of rage. They sounded unreal. He seemed to be floating in a silvery mist, with the pain in his wounded arm throb, throb, throbbing to the rhythm of the sea.

Then he saw that the light was moonlight, and the silver the sheen of the woman's garment. She sat at his feet, in the opening of the tent, with the moonlight falling on her hair. It was coiled like a coronet about her head, and he remembered thinking that she must be a queen in some magic land, like the ones in fairy tales.

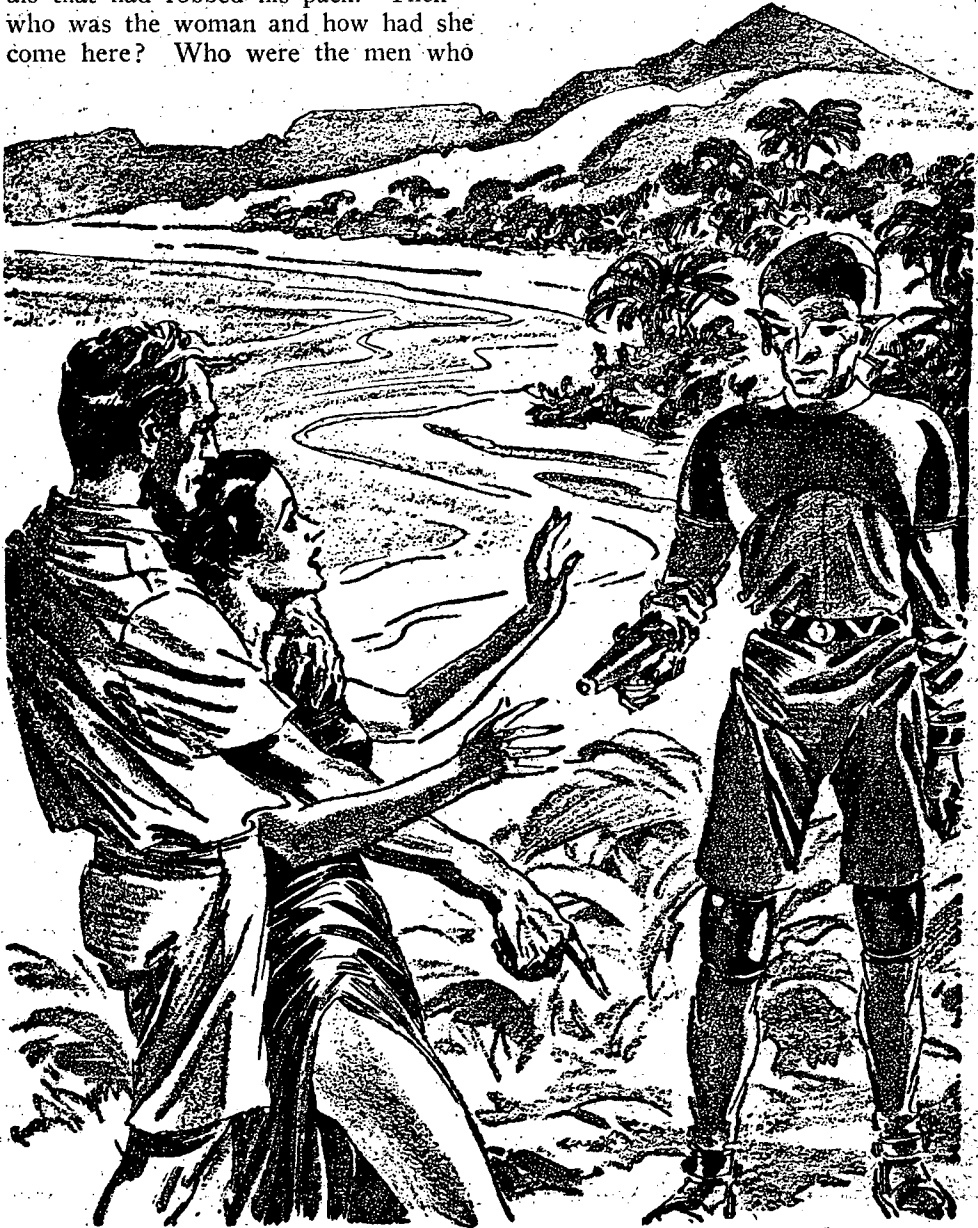
Some one moved, and he saw that there were others—men—crouching behind a breastwork of stone. They had cylinders like the one the woman had carried, and other weapons on tripods like parabolic microphones—great, polished reflectors of energy. The wall seemed more for concealment than protection, for he remembered the blasting power of the little cylinder and knew that no mere heap of rock could with-

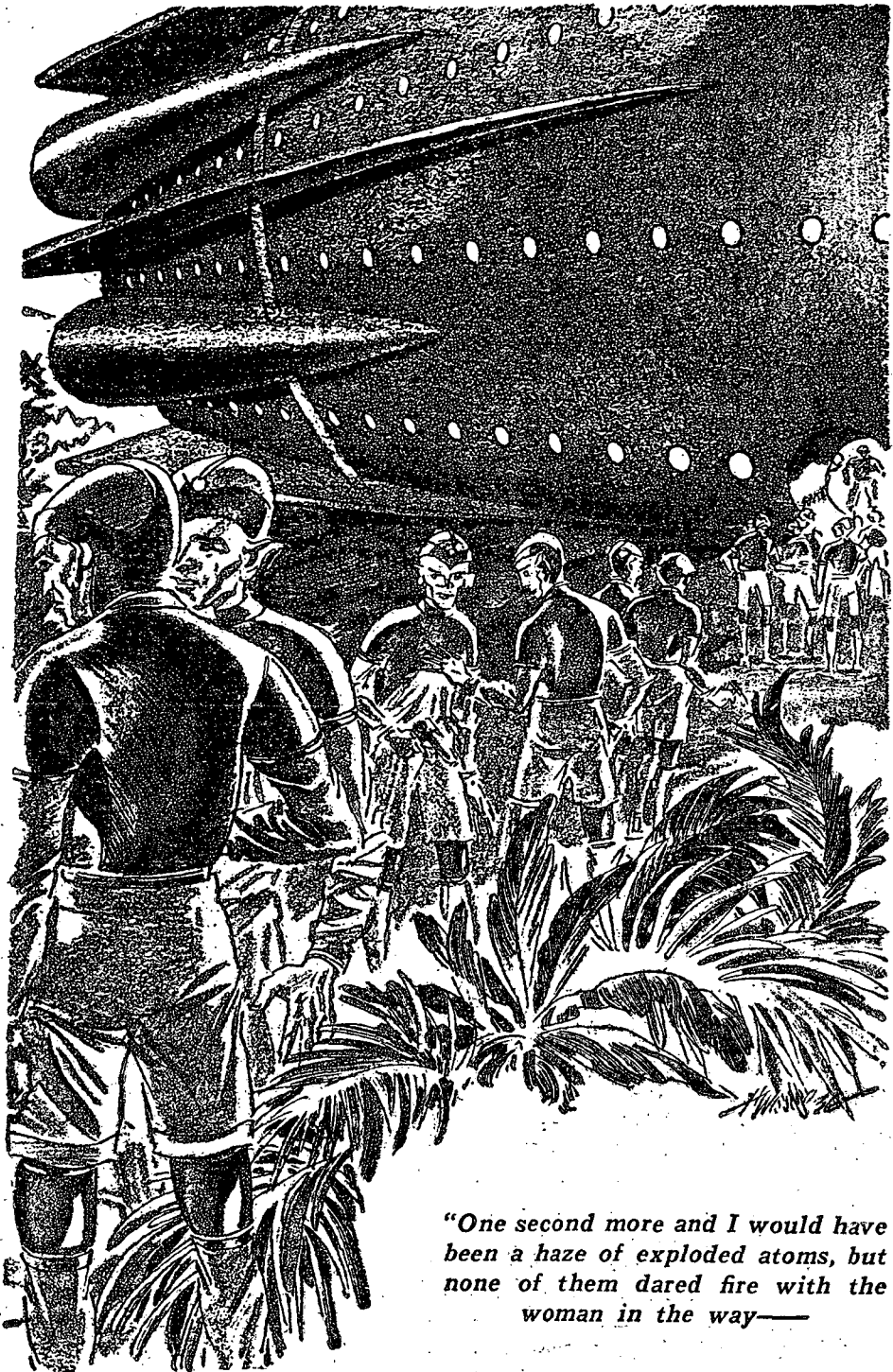
stand it long. Unless, of course, they were fighting some foe who lacked their science. A foe native to this Cretaceous age—hairy, savage men with stones and clubs.

Realization struck him. There were no men in the Cretaceous. The only mammals were the mouselike marsupials that had robbed his pack. Then—who was the woman and how had she come here? Who were the men who

guarded her? Were they—could they be—travelers in time like himself?

He sat up with a jerk that made his head swim. There was a shimmering, flowing movement in the moonlight and a small, soft hand was pressed over his mouth, an arm was about his shoulders, easing him back among the cushions.





"One second more and I would have been a haze of exploded atoms, but none of them dared fire with the woman in the way—

AST—9

She called out and one of the men rose and came into the tent. He was tall, nearly seven feet, with silvery white hair and a queer-shaped skull. He stared expressionlessly down at Donovan, questioning the woman in that same strange tongue. She answered him, and Donovan felt with a thrill that she seemed worried. The other shrugged—that is, he made a queer, quick gesture with his hands that passed for a shrug—and turned away. Before Donovan knew what was happening, the woman gathered him up in her arms like a babe and started for the door of the tent.

Terry Donovan is over six feet tall and weighs two hundred pounds. He stiffened like a naughty child. It caught her off-guard and they went down with a thud, the woman underneath. It knocked the wind out of her, and Donovan's arm began to throb furiously, but he scrambled to his feet, and with his good hand helped her to rise. They stood eying each other like sparring cats, and then Terry laughed.

It was a hearty Irish guffaw that broke the tension, but it brought hell down on them. Something spanged on the barricade and went whining over their heads. Something else came arcing through the moonlight and fell at their feet—a metal ball the size of his head, whirring like a clock about to strike.

DONOVAN moved like greased lightning. He scooped the thing up with his good hand and lobbed it high and wide in the direction from which it came, then grabbed the woman and ducked. It burst in mid-air with a blast of white flame that would have licked them off the face of the earth in a twinkling—and there was no sound, no explosion such as a normal bomb should make! There was no bark of rifles off there in the darkness, though slugs were thudding into the barricade and screaming overhead with unpleasant regularity. The tent was in ribbons, and seeing no

reason why it should make a better target than need be, he kicked the pole out from under it and brought it down in a billowing heap.

That made a difference, and he saw why. The material of the tent was evanescent, hard to see. It did something to the light that fell on it, distorted it, acting as a camouflage. But where bullets had torn its fabric a line of glowing green sparks shone in the night.

The enemy had lost their target, but they had the range. A bullet whined evilly past Donovan's ear as he dropped behind the shelter of the wall. His groping hand found a familiar shape—his rifle. The cartridge belt was with it. He tucked the butt between his knees and made sure that it was loaded, then rose cautiously and peeped over the barricade.

Hot lead sprayed his cheek as a bullet pinged on the stone beside him. There was a cry from the woman. She had dropped to her knees beside the tent, and he could see that the ricochet had cut her arm. The sight of blood on her white skin sent a burning fury surging through him. He lunged awkwardly to his feet, resting the rifle on top of the wall, and peered into the darkness.

Five hundred yards away was the jungle, a wall of utter blackness out of which those silent missiles came. Nothing was visible against its shadows—or was that a lighter spot that slipped from tree to tree at the very edge of the moonlight? Donovan's cheek nestled against the stock of his gun and his eyes strained to catch that flicker of gray in the blackness. It came—the gun roared—and out of the night rang a scream of pain. A hit!

Twice before sunup he fired at fleeting shadows, without result. Beside him, the oldest of the four men—the one he had seen first—was dressing the woman's wound. It was only a scratch, but Donovan reasoned that in this age

of virulent life forms, it was wise to take every precaution. There might be germs that no one had even heard of, lurking everywhere. The others were about his own age, or seemed to be, with the same queer heads and white hair as their companion's. They seemed utterly disinterested in him and what he was doing.

IV.

AS the first rays of the sun began to brighten the sky behind them, Donovan took stock of the situation. Their little fortress was perched on a point of rock overlooking the sea, with the plateau behind it. Salt marshes ran inland as far as he could see, edged with heavy jungle. And in the No Man's Land between the two was the queerest ship he had ever seen.

It was of metal, cigar-shaped, with the gaping mouths of rocket jets fore and after and a row of staring portholes. It was as big as a large ocean vessel and it answered his question about these men whose cause he was championing. They had come from space—from another world!

Bodies were strewn in the open space between the ship and the barricade. One lay huddled against a huge boulder, a young fellow, barely out of his teens as we would gauge it. Donovan's gaze wandered away, then flashed back. The man had moved!

Donovan turned eagerly to the others. They stared at him, blank-faced. He seized the nearest man by the shoulder and pointed. A cold light came into the other's eyes, and Donovan saw his companions edging toward him, their hands on the stubby cylinders of their weapons. He swore. Damn dummies! He flung the rifle down at the woman's sandaled feet and leaped to the top of the wall. As he stood there he was a perfect target, but no shot came. Then he was among the scattered rocks, zigzagging toward the wounded man. A moment

later he slid safely into the niche behind the boulder, and lifted the other into a sitting position against his knee. He had been creased—an ugly furrow plowed along his scalp—but he seemed otherwise intact.

Donovan got his good shoulder under the man's armpit and lifted him bodily. From the hill behind the barricade a shot screamed past his head. Before he could drop to safety a second slug whacked into the body of the man in his arms, and the youth's slim form slumped in death.

Donovan laid him gently down in the shelter of the boulder. He wondered whether this would be the beginning of the end. Under fire from both sides, the little fortress could not hold out for long. A puff of vapor on the hillside told him why the fire was not being returned. The damned cylinders had no range. That was why the enemy was using bullets—air guns, or whatever the things were. All the more reason why he should save his skin while the saving was good. He ducked behind the rock, then straightened up and streaked for the shelter of the trees.

Bullets sang around him and glanced whistling from the rocks. One whipped the sleeve that hung loose at his side and another grooved the leather of his high-top boots. All came from behind—from the hill above the camp—and as he gained the safety of the forest he turned and saw the foe for the first time.

They were deployed in a long line across the top of the ridge behind the camp. They had weapons like fat-barreled rifles, with some bulky contraption at the breach. As he watched they rose and came stalking down the hillside, firing as they came.

They were black, but without the heavy features of a Negro. Their hair was as yellow as corn, and they wore shorts and tunics of copper-colored material. Donovan saw that they were

maneuvering toward a spur from which they could fire down into the little fortress and pick off its defenders one by one. With the men at the barricade gone, they would be coming after him. If he started now, he might make his way through the jungle to a point where he could cut back across the hills and reach the Egg. He had a fifty-fifty chance of making it. Only—there was the woman. It was murder to leave her, and suicide to stay.

Fate answered for him. From the barricade he heard the roar of his rifle and saw one of the blacks spin and fall in a heap. The others stood startled, then raced for cover. Before they reached it, two more were down, and Donovan saw the woman's sleek black head thrust above the top of the rocky wall with the rifle butt tucked in the hollow of her shoulder.

That settled it. No one with her gumption was going to say that Terry Donovan had run out on her. Cautiously, he stuck his head out of the undergrowth and looked to left and right. A hundred feet from him one of the blacks lay half in and half out of the forest. One of the outlandish-looking rifles was beside him. Donovan pulled his head back and began to pry his way through the thick undergrowth.

THE DONOVAN LUCK is famous. The gun was intact, and with it was a belt case crammed with little metal cubes that had the look of ammunition. He poked the heavy barrel into the air and pushed the button that was set in the butt. There was a crackling whisper, barely audible, and a slug went tearing through the fronds above him. He tried again, and an empty cube popped out into his palm. He examined it carefully. There was a sliding cover that had to be removed before the mechanism of the gun could get at the bullets it contained. He slipped in one of the loaded cubes and tried again. A second

shot went whistling into space. Then, tucking the gun under his arm, he set out on a flanking trip of his own.

He knew the range of the weapon he was carrying, if not its nature, and he knew how to use it. He knew that if he could swing far around to the east, along the sea, he might come up on the ridge behind the blacks and catch them by surprise. Then, if the gang in the fort would lend a hand, the war was as good as over.

It was easier said than done. A man with one mangled arm strapped to his side and a twenty-pound rifle in his good hand, is not the world's best mountaineer. He worked his way through the jungle into the lee of the dunes that lay between the cliffs and the beach, then ran like blue blazes until he was out of sight of the whole fracas, cut back inland, took his lip in his teeth, and began to climb.

There were places where he balanced on spires the size and sharpness of a needle, or so he said. There were places where he prayed hard and trod on thin air. Somehow he made it and stuck his head out from behind a crimson crag to look down on a very pretty scene.

The ten remaining blacks were holed upon the crest of the ridge. They were within range of the camp, but they didn't dare get up and shoot because of whoever was using the rifle. That "whoever"—the woman, as Donovan had suspected—was out of sight and stalking them from the north just as he was doing from the south. The fighting blood of his Irish ancestors sizzled in his veins. He slid the misshapen muzzle of his weapon out over the top of the rock and settled its butt in the crook of his good arm. He swiveled it around until it pointed in the direction of two of the blacks who were sheltering under the same shallow ledge. Then he jammed down the button and held on.

The thing worked like a machine gun

and kicked like one. Before it lashed itself out of his grip one of the foemen was dead, two were flopping about like fish out of water, and the rest were in full flight. As they sprang to their feet the woman blazed away at them with the elephant gun. Then the men from the barricade were swarming over the rock wall, cylinders in hand, and mowing the survivors down in a succession of tiny puffs of blue smoke. In a moment it was over.

Donovan made his way slowly down the hillside. The woman was coming to meet him. She was younger than he had thought—a lot younger—but her youth did not soften her. He thought that she might still be a better man than he, if it came to a test. She greeted him in her soft tongue, and held out the rifle. He took it, and as he touched the cold metal a terrific jolt of static electricity knocked him from his feet.

He scrambled up ruefully. The woman had not fallen, but her eyes blazed with fury. Then she saw that he had not acted intentionally, and smiled. Donovan saw now why the blacks wore metal suits. Their weapons built up a static charge with each shot, and unless the gunner was well grounded it would accumulate until it jumped to the nearest conductor. His rubber-soled shoes had insulated him, and the charge built up on him until he touched the barrel of the rifle, whereupon it grounded through the steel and the woman's silvery gown.

THEY WENT down the hillside together. Donovan had given the woman the gun he had salvaged, and she was examining it carefully. She called out to the men, who stood waiting for them, and they began to search the bodies of the blacks for ammunition. Half an hour later they were standing on the beach in the shadow of the great rocket. The men had carried their equipment from the camp and stowed it away,

while Donovan and the woman stood outside bossing the job. That is, she bossed while he watched. Then he recalled who and where he was. Helping these people out in their little feud was one thing, but going off with them, Heaven knew where, was another. He reached down and took the woman's hand.

"I've got to be going," he said.

Of course, she didn't understand a word he said. She frowned and asked some question in her own tongue. He grinned. He was no better at languages than she. He pointed to himself, then up the beach to the east where the Egg should be. He saluted cheerfully and started to walk away. She cried out sharply and in an instant all four men were on him.

He brought up the rifle barrel in a one-handed swing that dropped the first man in his tracks. The gun went spinning out of his hand, but before the others could reach him he had vaulted the man's body and caught the woman to him in a savage, one-armed hug that made her gasp for breath. The men stopped, their ray guns drawn. One second more and he would have been a haze of exploded atoms, but none of them dared fire with the woman in the way. Over the top of her sleek head he stared into their cold, hard eyes. Human they might be, but there was blessed little of the milk of human kindness in the way they looked at him.

"Drop those guns," he ordered, "or I'll break her damned neck!" None of them moved. "You heard me!" he barked. "Drop 'em!"

They understood his tone. Three tapering cylinders thudded on the sand. He thrust the woman forward with the full weight of his body and trod them into the sand.

"Get back," he commanded. "Go on. Scram!"

They went. Releasing the woman, he leaped back and snatched up the

weapon she had dropped. He poked its muzzle at her slender waist and fitted his fingers cozily about the stock. He jerked his head back, away from the ship.

"You're coming with me," he said.

She stared inscrutably at him for a moment, then, without a word, walked past him and set off up the beach. Donovan followed her. A moment later the dunes had hidden the ship and the three men who stood beside it.

V.

THEN BEGAN a journey every step of which was a puzzle. The girl—for she was really little more—made no attempt to escape. After the first mile Donovan thrust the ray gun into his belt and caught up with her. Hours passed, and still they were slogging wearily along under the escarpment. In spite of the almost miraculous speed with which it was healing, the strain and activity of the past few hours had started his arm throbbing like a toothache. It made him grumpy, and he had fallen behind when a drumming roar made him look up.

It was the rocket ship. It was flying high, but as he looked it swooped down on them with incredible speed. A thousand feet above it leveled off and a shaft of violet light stabbed down, missing the girl by a scant ten feet. Where it hit the sand was a molten pool, and she was running for her life, zigzagging like a frightened rabbit, streaking for the shelter of the cliffs. With a shout, Donovan raced after her.

A mile ahead the ship zoomed and came roaring back at him. A black hole opened in the face of the cliff. The girl vanished in its shadows, and as the thunder of the rocket sounded unbearably loud in his ears, Donovan dived after her. The ray slashed across the rock above his head and droplets of molten magma seared his back. The

girl was crouching against the wall of the cave. When she saw him she plunged into the blackness beyond.

He had had enough of hide and seek. He wanted a show-down and he wanted it now. With a shout, he leaped after the girl's receding figure and caught her by the shoulder, spinning her around.

Instantly he felt like an utter fool. He could say nothing that she could understand. The whole damned affair was beyond understanding. He had strong-armed her into coming with him—and her own men had tried to burn her down. Her—not him. Somehow, by something he had done, he had put her in danger of her life from the only people in the entire universe who had anything in common with her. He couldn't leave her alone in a wilderness full of hungry dinosaurs, with a gang of gunmen on her trail, and he couldn't take her with him. The Egg would barely hold one. He was on a spot, and there was nothing he could do about it.

There was the sound of footsteps on the gravel behind them. In the dim light he saw the girl's eyes go wide. He wheeled. Two men were silhouetted against the mouth of the cave. One of them held a ray gun. He raised it slowly.

Donovan's shoulder flung the girl against the wall. His hand flicked past his waist and held the gun. Twice it blazed and the men were gone in a puff of sparkling smoke. But in that instant, before they were swept out of existence, their guns had exploded in a misdirected burst of energy that brought the roof crashing down in a thundering avalanche, sealing the cave from wall to wall.

The shock flung Donovan to the ground. His wounded arm smashed brutally into the wall and a wave of agony left him white and faint. The echoes of that stupendous crash died away

slowly in the black recesses of the cave. Then there was utter silence.

Something stirred beside him. A small, soft hand touched his face, found his shoulder, his hand. The girl's voice murmured, pleading. There was something she wanted—something he must do. He got painfully to his feet and awaited her next move. She gently detached the ray gun from his fingers, and before he knew it he was being hustled through utter darkness into the depths of the cave.

HE DID a lot of thinking on that journey through blackness. He put two and two together and got five or six different answers. Some of them hung together to make sense out of nightmare.

First, the girl herself. The rocket, and Donovan's faith in a science that he was proving fallible, told him that she must come from another planet. Her unusual strength might mean that she was from some larger planet, or even some other star. At any rate, she was human and she was somebody of importance.

Donovan mulled over that for a while. Two races, from the same or different planets, were thirsting for each other's blood. It might be politics that egged them on, or it might be racial trouble or religion. Nothing else would account for the fury with which they were exterminating each other. The girl had apparently taken refuge with her bodyguard on this empty planet. Possession of her was important. She might be a deposed queen or princess—and the blacks were on her trail. They found her and laid siege—whereupon Terry Donovan of 1937 A. D. came barging into the picture.

That was where the complications began. The girl, reconnoitering, had saved him from the dinosaur which was eating him. Any one would have done as much. She lugged him back to camp

—Donovan flushed at the thought of the undignified appearance he must have made—and they patched him up with their miraculous green ointment. Then the scrap began, and he did his part to bring them out on top. Did it damn well, if any one was asking. Donovan didn't belong to their gang and didn't want to, so when they started for home he did likewise. Only it didn't work out that way.

She had ordered her men to jump him. She wanted to hang on to him, whether for romantic reasons, which was doubtful, or because she needed another fighting man. They didn't get very far with their attempt to gang up on him. That was where the worst of the trouble began.

Grabbing her as he had had been a mistake. Somehow that act of touching her—of doing physical violence to her person—made a difference. It was as though she were a goddess who lost divinity through his violence, or a priestess who was contaminated by his touch. She recognized that fact. She knew then that she would have short shrift at the hands of her own men if she stayed with them. So she came along. Strangely enough, the men did not follow for some time. It was not until they returned to the rocket, *until they received orders from whoever was in that rocket*, that they tried to kill her.

Whoever was in the rocket! The thought opened new possibilities. A priest, enforcing the taboos of his god. A politician, playing party policy. A traitor, serving the interests of the blacks. None of these did much to explain the girl's own attitude, nor the reason why this assumed potentate, if he was in the rocket during the battle, had done nothing to bring one side or the other to victory. It didn't explain why hours had passed before the pursuit began. And nothing told him what he was going to do with her when they reached the Egg, if they ever did.

The cave floor had been rising for some time when Donovan saw a gleam of light ahead. At once the girl's pace quickened, and she dropped his arm. How, he wondered, had she been able to traverse that pitch-black labyrinth so surely and quickly? Could she see in the dark, or judge her way with some strange sixth sense? It added one more puzzle to the mysteries surrounding her.

HE COULD HAVE DANCED for joy when they came out into the light. They had passed under the ridge and come out at the foot of the cliffs which he had climbed hours before. The whole landscape was familiar: the gullies in the barren plain, the fringe of swamp and jungle, and the reefs over which the oily sea was breaking. There, a few miles to the north, the Egg was hidden. There was safety—home—for one.

She seemed to know what he was thinking. She laid a reassuring hand on his arm and smiled up at him. This was his party from now on. Then she saw the pain in his eyes. His arm had taken more punishment than most men could have stood and stayed alive. Her nimble fingers peeled away the dressing and gently probed the wound to test the position of the broken bones. Evidently everything was to her liking, for she smiled reassuringly and opened a pouch at her waist, from which she took a little jar of bright-green ointment and smeared it liberally on the wound.

It burned like fire, then a sensuous sort of glow crept through his arm and side, deadening the pain. She wadded the dirty bandages into a ball and threw them away. Then, before Donovan knew what was happening, she had ripped a length of the metallic-looking fabric from her skirt and was binding the arm tightly to his side.

Stepping back, she regarded him with satisfaction, then turned her attention to the gun she had taken from him. A

lip of the firing button and an empty cartridge cube popped out into her palm. She looked at him and he at her. It was all the weapon they had, and it was empty. Donovan shrugged. Nothing much mattered anyway. With an answering grimace she sent it spinning away among the rocks. Side by side, they set off toward the coast and the Egg.

It was the sky that Donovan feared now. Dinosaurs they could outwit or outrun. He thought he could even fight one of the little ones, with her to cheer him on. But heat rays shot at them from the sky, with no cover within miles, was something else again. Strangely enough, the girl seemed to be enjoying herself. Her voice was a joy to hear, even if it didn't make sense, and Donovan thought that he got the drift of her comments on some of the ungainly monstrosities that blemished the Cretaceous landscape.

Donovan had no desire to be in the jungle at night, so they took their time. He had matches, which she examined with curiosity, and they slept, back to back, beside a fire of grass and twigs in the lee of a big boulder. There was nothing to eat, but it didn't seem to matter. A sort of silent partnership had been arrived at, and Donovan, at least, was basking in its friendly atmosphere.

VI.

EVERY ROAD has its ending. Noon found them standing beside the leaden hulk of the Egg, face to face with reality. One of them, and only one could make the journey back. The Egg would not hold two, nor was there power enough in its accumulators to carry more than one back through the barrier between time coils. If the girl were to go, she would find herself alone in a world unutterably remote from her own, friendless and unable to understand or to make herself understood. If Dono-

van returned, he must leave her here alone in the Cretaceous jungle, with no food, no means of protection from man or beast, and no knowledge of what might be happening sixty million years later which would seal her fate for good.

There was only one answer. Her hand went to his arm and pushed him gently toward the open door of the Egg. He, and he alone, could get the help which they must have and return to find her. In six hours at the outside the Egg should be ready to make its return trip. In that six hours Donovan could find me, or some other friend, and enlist my aid.

Fortune played into his hands. There was a patter of footsteps among the fallen fronds, and a small dinosaur appeared, the body of a bird in its jaws. With a whoop, Donovan sprang at it. It dropped the bird and disappeared. The creature was not dead, but Donovan wrung its scrawny neck. Here was proof that must convince me of the truth of his story—that would bring me to their aid!

He stepped into the machine. As the door swung shut, he saw the girl raise her hand in farewell. When it opened again, he stepped out on the concrete floor of his own laboratory, sixty million years later.

His first thought was for the generators that would recharge the batteries of the Egg. Then, from the house and the laboratory, he collected the things that he would need: guns, food, water, clothing. Finally, he set out to fetch me.

HE SAT THERE, his broken arm strapped to his side with that queer metallic cloth, the torn flesh painted with some aromatic green ointment. A revolver in its holster lay on the desk at his elbow; a rifle leaned against the heap of duffel on the floor of the Egg. What did it all mean? Was it part of some incredibly elaborate hoax, planned

for some inconceivable purpose? Or—fantastic as it seemed—was it truth?

"I'm leaving in ten minutes," he said. "The batteries are charged."

"What can I do?" I asked. "I'm no mechanic—no physicist."

"I'll send her back in the Egg," he told me. "I'll show you how to charge it—it's perfectly simple—and when it's ready you will send it back, empty, for me. If there is any delay, make her comfortable until I come."

I noted carefully everything he did, every setting of every piece of apparatus, just as he showed them to me. Then, just four hours after he threw that incredible bird down at my feet, I watched the leaden door of the Egg swing shut. The hum of the generators rose to an ugly whine. A black veil seemed to envelop the huge machine—a network of emptiness which ran together and coalesced into a hole into which I gazed for interminable distances. Then it was gone. The room was empty. I touched the switch that stopped the generators.

The Egg did not return—not on that day, nor the next, nor ever while I waited there. Finally, I came away. I have told his story—my story before—but they laugh as I did. Only there is one thing that no one knows.

THIS YEAR there were new funds for excavation. I am still senior paleontologist at the museum, and in spite of the veiled smiles that are beginning to follow me, I was chosen to continue my work of previous seasons. I knew from the beginning what I would do. The executors of Donovan's estate gave me permission to trace the line of the ancient Cretaceous beach that ran across his property. I had a word picture of that other world as he had seen it, and a penciled sketch, scrawled on the back of an envelope as he talked. I knew where he had buried the cube of radium. And it might be that this beach of fossil

sands, preserved almost since the beginning of time, was the same one in which Terry Donovan had scooped a hole and buried a leaden cube, sealed in a steel box.

I have not found the box. If it is there, it is buried under tons of rock that will require months of labor and thousands of dollars to remove. We have uncovered a section of the beach in whose petrified sands every mark made in that ancient day is as sharp and clear as though it was made yesterday: the ripples of the receding tide—the tracks of sea worms crawling in the shallow water—the trails of the small reptiles that fed on the flotsam and jetsam of the water's edge.

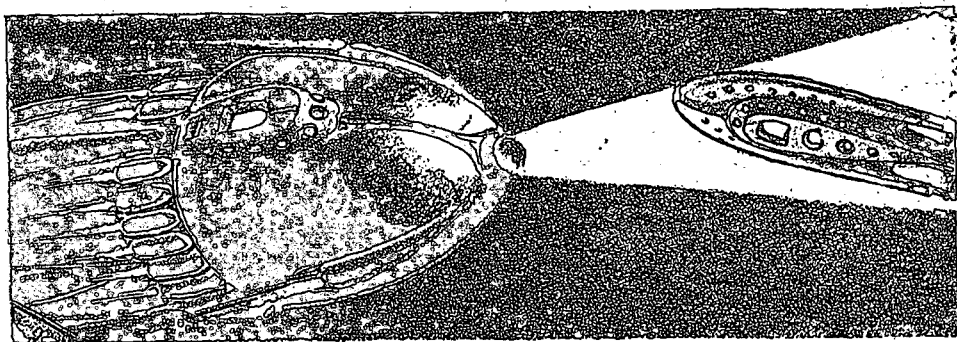
Two lines of footprints come down across the wet sands of that Cretaceous beach, side by side. Together they cross the forty-foot slab of sandstone which I have uncovered, and vanish where the rising tide has filled them. They are prints of a small, queerly made sandal and a rubber-soled hiking boot—of a man and a girl.

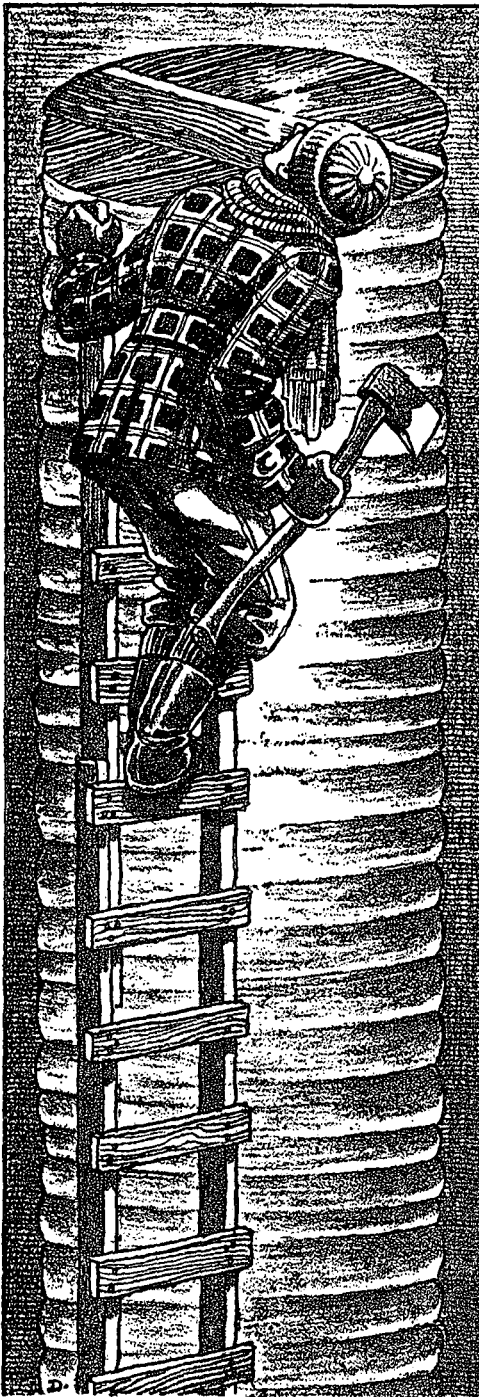
A third line of tracks crosses the Cretaceous sands and overlies those others—huge, splayed, three-toed, like the prints of some gigantic bird. Sixty million years ago, mighty Tyrannosaurus and his smaller cousins made such tracks. The print of one great paw covers both the girl's footprints as she stands for

a moment, motionless, beside the man. They, too, vanish at the water's edge.

That is all, but for one thing: an inch or two beyond the point where the tracks vanish, where the lapping waters have smoothed the sand, there is a strange mark. The grains of sand are fused, melted-together in a kind of funnel of greenish glass that reminds me of the fulgurites that one often finds where lightning has struck iron-bearing sand, or where some high-voltage cable has grounded. It is smoother and more regular than any fulgurite that I have ever seen.

Two years ago I saw Terry Donovan step into the leaden Egg that stood in its cradle on the floor of his laboratory, and vanish with it into nothingness. He has not returned. The tracks which I have described, imprinted in the sands of a Cretaceous beach, are very plain, but workmen are the only people besides myself who have seen them. They see no resemblance to human footprints in the blurred hollows in the stone. They know, for I have told them again and again during the years that I have worked with them, that there were no human beings on the earth sixty million years ago. Science says—and is not science always right?—that only the great dinosaurs of the Cretaceous age left their fossil footprints in the sands of time.





*A cold chill crept up his spine—
The top was sealed beyond his ability to break through—*

WINTER on the PLANET

—sealed in an ice cocoon.

by Warner Van Lorne

NEW YEAR'S EVE, 1943-44 was the worst in the meteorological records of the New York weather bureau.

Crowds, which in other years had jammed Times Square in a mad turbulence, were individually trying to forget the weather by remaining at home. Reservations in restaurants and clubs were not filled. Policemen, here and there, hunched their shoulders toward the cold—and the driving rain which, in all reason, should have turned to snow or hail. Traffic officers huddled on the sidewalks in the shelter of buildings. There was no traffic to direct.

Ice coated the pavements four inches deep. The street department had given up hope of removing it—and hoped for a change in the weather instead! Even the facings of the buildings wore a glistening coat of ice two inches thick. The city had the appearance of having been dipped in cold water, then put out to freeze!

To-night marked the third full week of rain, followed always by icy blasts that froze the water where it struck. The result was the glistening, crystal city. Strangely, in three weeks the cold waves had never struck quite soon enough to turn the rain to hail.

Surface transportation was nearing a standstill. Subway and elevated lines

were jammed to the danger point. People had to get to and from work.

Two more weeks passed, with conditions growing continually worse. Ice more than six inches thick covered every building and every exposed surface in the metropolis. The ice in the streets was nearly three feet deep.

Rain fell intermittently, followed always by subzero temperatures. In each succeeding cold wave the ice expanded, thickened, but was sealed over with a new layer before it could crack. The ice built strength as well as weight, so that, surprisingly, there were no collapsed roofs on the record, even though in some cases the foundations cracked under the pressure of expanding ice.

Worry was turning to fear on the part of both government and people. The city faced a serious fuel shortage, and an absolute stoppage of deliveries. Railroads were blocked completely by a lake of ice which had conquered their machinery and covered the rights of way. Food supplies neared exhaustion—with no means to replenish them.

Fully half the business establishments were closed. More were shutting down daily. The elevated lines were blocked. Subways still moved by keeping large crews working night and day on exposed tracks.

Where power lines were above ground the city had been dark for days. Clinging ice had torn the lines down, and repair was hopelessly out of the realm of possibility.

Families, unable to obtain fuel, began using forgotten fireplaces in small apartments. Slowly, reluctantly, every inflammable object was burned for heat.

In the outlying sections of individual homes new problems rose. An unused building disappeared between dark and dawn. One man took the doors. Neighbors saw him, and followed, ripping out floors and window frames. With axes and bars they ripped out the walls, the beams, the roof boards!

Morning light shone on the first glistening ice mold in New York—though before a week had passed the one had become many.

The rural communities were more fortunate. Many families had fuel stored for a long winter. Others had spare buildings that could be burned. There was canned food, fruit, eggs, potatoes, apples, carrots, and cider, in the cellars—and cattle, pigs, and chickens in the barns. The small communities could live for months without hardship, but every city dweller in the northern half of the United States was suffering.

BY THE END of January, ice had attained unbelievable thickness, coating many a building on the windward side three and more feet thick. New York's rivers were frozen solid and an ice pack of increasing menace blocked the harbor. Shipping was paralyzed. Coal and oil, which had been reaching the docks in small quantities, stopped altogether.

The city was marooned, sealed in an ice cocoon. There was no single source from which to replenish food or fuel. Disaster faced millions of people unless there came a thaw.

Millions of eyes watched as thermometers dropped lower, and hope dwindled. Rain fell each day, with the temperature creeping up to the freezing point just long enough to allow for the precipitation. Then it would sink rapidly, blasting all hope of a thaw, and sealing the new coating of ice.

Food was disappearing. People purchased any nourishment they could find. Those who could no longer purchase, helped themselves.

Many families hoarded food against the time of famine. They moved in armed groups when they carried food in the streets. Murder for food was becoming common.

Public buildings with heat were thrown open to those whose fuel was

exhausted. Meager rations of food were supplied to the huddled refugees. The authorities attempted to confiscate all available food supplies so as to ration it equally.

Dairy farms near the city began losing cattle and threw heavy police guards around their barns. This protection served for one week to save the herds from the gangs of men who had slaughtered and divided the meat. Then the government stepped in and confiscated for the public emergency.

Even the animals in the zoos fell prey to the municipal butchers. As the pangs of hunger became keen, many were glad to eat monkey, zebra, or elephant meat! It was better than nothing.

The fish in the aquarium at the Battery disappeared in one night, except the electric eels, and two frozen corpses testified as to why they were spared!

Authorities were helpless. They tried desperately to open the harbor to shipping, but the ice pack ground the ice breakers to bits! Finally, they dynamited a channel from the Battery to the open water and four ships were able to unload their cargoes.

Thousands stormed the undernourished policemen who guarded the docks. One banana ship was wrecked; the cargo carried away almost piecemeal. Three hundred men and women died in the fight with the police, and many starving officers died with them!

Hospitals were stormed and their commissaries robbed of food which had been saved to keep patients alive. All restaurants were closed—but they were broken open and searched, one after another. Nothing anywhere was sacred, or above attack.

THE DAY CAME when a pale-faced mayor, and a distraught police commissioner gazed at a pitiful heap of fresh human bones from which the flesh had been stripped. They had been cooked. The policeman who had found

and brought the bones in gazed hopelessly at the two men.

"Men," the mayor said, "I want your word that no syllable of this shall ever pass either of your lips. With millions of people still alive there are many to whom the news would be a suggestion. Heaven save us from that day."

"You have our word," the commissioner said faintly. "I—we're beaten, your honor. Must I keep my men on the job?"

"Until the last one dies," the mayor answered. "It's our only hope: that they remain loyal."

The commissioner nodded and left the room, his arm thrown encouragingly across the shoulders of Officer Mahan.

The ice coat grew thicker. Some flat-roofed buildings collapsed, groaning under the weight. Private houses with peaked roofs formed an ice dome and were held rigid in the grip of frozen support.

By the end of February the mortality among the inhabitants of the great Northern cities was tremendous in its daily totals. The continued cold had warded off diseases due to poor sanitation. But starvation cut the population down faster than the black plague had decimated medieval Europe.

The dead were carried to the street and given to the god of ice. No other disposal was possible.

Rural communities had been free from raids from the cities, because travel was impossible. This saved the lives of the rural population. Their food supply was safely arranged, and could not be reached by insane mobs.

Country villages were the last settlements to feel the food shortage. Many of the villagers had ample supplies. Others had none. This led to the robbery and murder conditions of the cities, but on a smaller scale. People in these communities finally banded together, armed to the teeth for protection, and

stood guard over their perishable treasures, night and day.

Farmers with barns close to their houses were lucky. Others had to battle their way over ridges of ice on which they had sprinkled ashes. News came over the radio that the cities were doomed, before the broadcasts stopped. Grizzled, far-seeing farmers began killing all surplus live stock, dressing the hides and freezing the meat for future use.

Still the ice thickened, and countrymen scanned the skies in vain for a sign of spring. There was no sign, but by word of mouth men learned that the oceans were freezing all along the coast. And though there was no way for them to know, Europe and Asia, and the southern continents were suffering under the same catastrophe.

Snow fell on the Sahara, was melted by the sun, and a chill blast turned the water to ice before the sand could suck it all beneath the surface. More snow fell, melted, and froze!

Word spread of the mist that rose from the ocean and drifted shoreward, of the rumor that high tide lacked a foot of its former level.

The air was warm, high above the earth, and dropped moisture to the icy blanket every day, to thicken it. Thunderstorms came—always far in the distance—yet men felt the shock of electricity through the ice.

Ice ten to twelve feet thick blanketed the colder portions of North America by the end of March. The weather was getting colder! Below-zero temperatures became regular features of the night.

The tremendous, glassy coverings of the buildings served as an insulating medium, and made the buildings easy to

The rural districts were not suffering from cold.

The cities had suffered a terrible extinction. Little of their teeming life remained. The survivors roamed aim-

lessly, bundled in fur coats and spiked shoes (which were theirs for the taking) searching, ever searching, for food. Furtive outcasts, like jackals, sneaked among the mountainous heaps of victims to hack off chunks of frozen flesh!

The great, throbbing, teeming life was gone. The law of the survival of the fittest ruled the last days of the survivors. The stronger lived alone now; but when they met they fought, and usually only one survived a fight.

Although no man could see or know all that happened, he guessed. The population of the globe was only a tiny fraction of its total of six months before. No section of the surface was free of ice. In the tropics, where the blanket was not so thick, the natives were not equipped even to face freezing weather. Ice reached farther and farther toward the warm currents of the oceans. The mists above these currents thickened and drifted away shoreward, and the levels of the oceans had dropped another foot!

By July 1, 1944, no square foot on the surface of the earth was free of ice—except spots about some of the hot geysers in the Yellowstone National Park! Every man who walked the earth knew he faced eventual extinction by a new ice-age!

By mid-September the oceans were frozen over. The thickness of the salt ice varied with the length of time that particular part of the surface had been frozen. Life in the cities was extinct, but farm life still existed. In the northern sections, people no longer knew what the temperature was. Household thermometers would not register low enough.

Rural communities which had managed to survive, had been strained to the limit on scant rations. Hardy though they were, these people were slowly following the city population to extinction.

Thrifty farms with their supplies of food and fuel were the only spots where

hope had not left completely. And now the ice was so thick that men had chipped and chopped tunnels to their outbuildings. Some farms were short of food, but many had an ample store to last two or three years when they had killed the surplus stock to save fodder, and had frozen a ton or two of meat for future use.

Forward-looking farmers might keep a bull and two good cows, a rooster and some hens, a boar and a sow, a stallion and a mare. Taken in the aggregate, on one farm or another, every species of fowl and domestic animal was saved and could replenish its kind if the weather tempered.

Wild life? No one knew what had become of it.

On the big cattle ranches which had survived throughout the West, cattle were killed by the hundred and packed in huge barns and outhouses from floor to roof. Those who had fuel enough to match the supply of food were lucky.

AS the ice sheet deepened across the broad acres of George Doolit's farm, he took inventory of his stock and supplies. He had planned safely for a long winter, but six feet of ice was not going to melt in time to give him June pasturage. Some of those ice ridges where wind eddies had swept the water in waves, stood as much as ten feet thick—and George proceeded to do a lot of calculating as to the immediate futures of his family, his stock, and their combined food supplies. George had invested in six fine Jersey cows the previous fall, and his problem was thus more acute than usual.

He knew what had taken place in the rest of the world. The ice was universal, according to the last faint reports he had received before the radio finally blanked out. Doolit was a practical man. The thought occurred, though he tried to brush it aside, that the ice may have come to *stay*! He

hummed a tune, not realizing it was "Nearer, My God, To Thee," as he speculated on the wisdom of pilfering a gigantic hay barn which was not his property, but which stood only a mile distant.

Hay, if it were cooked, could be fed to the pigs and chickens. Enough hay, without cooking, would keep cattle and horses alive. Alfalfa hay would serve both purposes, and that near-by barn stored plenty of alfalfa!

Doolit's own supply wouldn't last beyond May. He'd be out of grain, except for seed, by April. Conditions had changed in the world. He couldn't look outside for help. There wasn't any outside!

It was a superhuman task to haul a load of hay over glazed ridges of wet ice in a biting wind. Every step of the journey was fraught with dangers which can only be understood by a chauffeur with smooth tires and no chains who has tried to drive up a hill on glare ice. But between dawn and dark, George roughed a trail, chipped a path, and sharpened the points on his horses' shoes.

For three more days he worked each day until his team could stand on trembling legs no longer, drawing baled hay from a hole cut in the side of the great barn, across the mile-long ice to his own buildings. His wife and three children, the youngest a boy of ten, stored the bales in every available mow, bin, and corner of every building within easy reach of the house.

Doolit was able to make the trip and return with a load of about three tons, every two hours. Twice he tipped over precious loads and had to stop, right his sleigh, and reload on the treacherous prairie of wind-swept glaze. But his barns filled up slowly. And even his youngest son seemed to realize the anxiety which gripped his parents, and worked like a Trojan. So Doolit hauled, and his family stored, more than

sixty tons of hay in those three days, till the barns were filled to bursting, the team was ready to collapse, and the man and his family were sorely tired.

With his own hay supply, George now had more than ninety tons, and his stock could live when there was no other stock alive in that section of the country! He had assured his egg supply, his milk, butter and cheese; together with chickens, pigs, and calves for his own table. The Doolit family would be able to eat, long after the hay was gone—if that became necessary in the final emergency.

George had a mushroom cellar. He sprouted his oats to supply greens both to his family and his live stock.

Fall came with no sign of a lessening of the ice peril, let alone a growing season. Farmers all over the nation ran short of food. More and more cattle and live stock were killed off to keep families alive. Scurvy broke out in some places which were governed by men lacking the foresight of a Doolit.

By December 1, 1944, the cattle in the United States numbered less than five thousand head! Hogs were still living only in a few scattered places.

ONE BIG FARM in the Middle West still had its stock intact and could feed for another calendar year! The owner was in the habit of selling tremendous stores of hay, but this last year he had held it to wait for higher prices! When the ice came, he found himself with every building filled to the roof! He, like George Doolit, took stock and thanked a kind Providence that he could feed his cattle, chickens, sheep and hogs. A litter of sixteen little pigs, arriving in the late fall of the ice year, were cared for like precious gems in a jeweler's show case.

March 1, 1945! Ice had reached the level of roof tops. Survivors could only speculate as to how far the ocean levels had receded. But oxygen became

scarce and thrifty farmers chopped and melted holes straight upward to the outer air outside their houses. Openings above the chimneys where escaping heat had served to keep a vent, completed a crude ventilation system.

But bitter cold swept into the houses through the downdraft. It provided life-giving air, but proved the temperature to be unbelievably low above the surface of the ice. People suffered with cold more than at any previous time, and the fuel supplies dwindled rapidly. The choice of man seemed to lie between suffocating and freezing. Doolit compromised by setting a movable trap at the upper opening of his outside vent, so he could open it at intervals, then stop the draft again.

APRIL 15, 1945! Doolit's supply of hay was growing meager. The huge hay barn a mile away might as well have been in Siberia. He had kept his stock alive and healthy for a year and a half and dreaded the idea of being forced to sacrifice it. But something had to be done. Even fuel was becoming scarce. Two of the outbuildings, emptied of hay, had been wrecked and used for heating and cooking. He could not rip apart the barns which housed the live stock. It was impossible to reach the nearest trees.

June 1, 1945: Doolit decided some of his cattle must die, and most of his chickens. The decision set a time clock on life, for when these had been consumed little food would remain. For months now, the family had lived on eggs, complemented by pork and veal at intervals, with mushrooms and steamed alfalfa to preserve a balance.

The tunnel between the house and barns did not seem cold this morning. The powdered ice underfoot seemed almost on the verge of melting, yet the sides and top of the tunnel were crystal-hard.

Mechanically, he climbed the fifty-foot

ladder to open the trap on top of the air vent. His shoulders hunched and pushed at the expected film of ice—but there was no give. He swung his ax at the edges, but there was no slightest indication of give. A cold chill crept up his spine and he worked frantically, for a premonition gripped him. The top was sealed beyond his ability to break through!

Terrific, absolute cold *must* have de-

scended on the outer world to congeal every last atom of potential moisture in the atmosphere! A cold, which, had it not been sealed out by the new ice, would have frozen them in their beds!

George descended the ladder like a man in a daze. He picked up the chipped ice and carried it into the house to be melted for drinking purposes. Strange that the air held little taint. The ice must have sealed over the trap al-



*Other human beings! His heart surged— He had thought
himself alone in the world—*

AST—10

most immediately after he had closed it. They had lived a full day without fresh air.

There had been no fire. Since the fuel situation had become acute, cooking had been done once each week, instead of daily. The family dressed warmly against the cold six days out of seven.

The air vent near the barn was, of course, sealed forever also. George decided not to alarm his family by telling them his fears. The confined odors of packed manure would reveal the facts soon enough. He forced an attitude of cheerfulness as he returned to the house for the meal which they would call breakfast.

But the doom of the live stock, cattle, hogs, and chickens, was as tightly sealed as were the tops of the air vents. Their death would purchase yet a little span of life for the family. Doolit's head was proudly high as he walked slowly toward the barn. They would feast during these last days.

Other occupied habitations faced the same inevitable problem. Life, which had survived the decimation of the world, must end. Rugged-thinking individuals faced their first insurmountable obstacle. They had fought while weaker men died, but there was no weapon capable of fending off this last, inevitable extermination. Some men cursed, others prayed, still others were silent in the face of disaster. Here and there a man weaker than the others killed his family and himself rather than risk the last insane suffering which would precede death by suffocation.

Great men had passed without complaint, taking the fate the world offered them—her offspring. It seemed strange that the mighty globe should mother life for untold centuries, then turn in a moment to annihilate it!

THE MID-WESTERN farmer smiled. It was simply another turn of

fate. He had been able to keep many cattle, hoping that one day he could again pasture them. Now he knew he faced the last few days of life, and smiled at the prospect as a new adventure. He greeted his wife pleasantly as he entered the house with the knowledge.

"Well, Mary," he said, still smiling, "I guess our work is about over. It won't be long before we follow those who've gone ahead. But I guess we can take it, can't we, sweetheart?"

And the gentle-faced, gray-haired woman reflected his smile as she reached her arms out to embrace him.

"Certainly, John. We've worked hard and had our share of life in return. I think it's time we had a rest. We haven't taken a vacation in a long time. It's time we had one."

But the hired men could not see that viewpoint, and worked in shifts, hour after hour, day after day, to break through the unknown thickness of ice which sealed the vents. They wouldn't admit themselves beaten by nature, whatever the old man said or did!

GEORGE DOOLIT left the house after breakfast, determined that his family would enjoy the greatest feast in months before night. They should have all the chicken they wanted to eat.

Next would come the hogs, and they would use only the choicest cuts. The young cattle would follow, to provide the choicest parts of the beef! None of the meat was very tender. A diet of hay does not build juicy meat. But it would taste mighty good.

Small amounts of grain were stored away for seed, if the soil was ever again in condition to be cultivated. But there wasn't enough to fatten an animal, and time was too short.

As Doolit walked between the house and barn, his feet sank into the earth slightly. For a moment he couldn't credit the sensation, but it was true. *The earth was thawing!*

Forgetting the mud, forgetting everything but the first sign of mellow ground, he fell to his knees and drove his fingers into the surface. It *was* true!

Ice surrounded him on every side, as hard as it had ever been. No—near the ground it was softer, and small drops of water occasionally trickled down to soak into the ground.

Several times he worked his fingers back and forth in the loam he loved so well. Then his mind snapped back to the present. Suppose it did thaw at the surface? There was an unknown thickness of ice overhead. This would gradually sink, to crush whatever was beneath. There would be floods to drown every living thing before the moisture would attain its proper balance in the air and in the sea.

As George passed each animal in the barn he stroked its head affectionately. It would be hard to kill the stock, but it would be merciful.

He reached the section of haymow closed off for the chickens. They had been moved into the big barn months before, so their coop could be used for fuel. Wire closed in enough space for them to exist.

There were no chickens beyond the wire!

Twice he rubbed his eyes and looked again. They were gone, without a trace! Gone, with no place to go! He stared at the empty space, then went inside the wire.

The bottom of the mow was level with the ground, and none too tight. In one place there was room for a chicken to squeeze through. But George still didn't understand as he kneeled down to look through the opening.

Faintly then, as if far in the distance, he heard the excited cackling of his fowls. His eyes popped as he caught sight of one as it passed through what appeared to be a small ice cave! As

far as his vision could reach, the ice had thawed in waves!

In numerous places it was solid to the ground, but in the wavelike formations between these spots it seemed to curve upward in low domes. The chickens had found passageways from one dome to another, scratching as they went.

The overhead ice had thickened until it made a perfect insulator for the surface of the earth. The internal heat had thawed the ground, and, working upward to the undersurface of the ice, had drunk the moisture, and so far avoided floods.

In the section around the house and barns this warmth had had less effect, due to the cold air which had permeated the passages during the ventilation period each day. But where no cold had offset the earth heat it had thawed waves under the sea of ice. Sealing of the air vents had thawed a tiny opening at the edge of the barn, and the chickens had used it.

The atmosphere *was* warmer in the ice tunnel. It was above the freezing point, but what effect this would have on the overhead ice Doolit dared not guess. Meantime fate had delayed the final curtain once more. Air, recreated in the caves beneath the ice, would release enough oxygen to breathe, and they would await further developments.

Two days later the ice began to lift from the ground in spots beside the tunnel. Several of these spots were thawing fast, but for only a few feet above the surface.

The chickens hadn't eaten their cooked hay the last two nights. They had come into the coop before the dim light faded, but seemed not to be interested in their accustomed food. Once more, George glued his eyes to the opening in the side of the barn. Finally a pullet wandered into view, pecked at something in the soil, then lifted its head with a *blade of green grass* in its beak!

LIFE had not been pleasant since the ice closed over the vents. There could be no fire; there was no outlet for the smoke. But the Doolits had managed to eat raw eggs, and finally raw meat. Gradually, they had come to the point where they no longer disliked uncooked food.

Two weeks passed, with the ice caves growing larger every day. The time came when George ripped a board from the side of the chicken coop, and followed the trail through the ice on hands and knees.

The chickens had been roaming farther from the barn each day, and he found, in the glasslike paradise, some caves large enough to let him stand erect. The solid blocks of ice which supported the overhead mass, were growing smaller.

On the third day of his explorations he was able to reach the hay barn, a mile distant. He had found fences still standing, and in some places he was able to follow the road to keep his sense of direction. His feeling of confinement was passing.

The thaw was peculiar. In places it covered nearly an acre, with domes of varied size. Then he would find solid ice over an area three hundred feet square—with no sign of melting. The earth did not release its heat everywhere, only in spots, probably due to the geological formations of the sub-strata.

The temperature was uncomfortable, but the survivors did not suffer. It was above freezing point, and they wore clothes to offset the dampness—clothes which were slowly becoming entirely homespun.

Grass was quite green by the time the ice thawed to leave large caves. The day came when the cattle were turned out to the first green food they had tasted in two years! They ate hungrily, but after an hour George had to call on his family to help get them back into the

barn. It was like playing hide and seek in the caves. But he dared not leave them in the maze too long at a time, at first.

The cows had been hemmed in by the old fences or it would have been impossible to round them up at all. The caves led on endlessly, if you followed the twists and turns between the pillars.

Sight of the strong, fairly healthy grass, gave Doolit another idea. He carefully planted a few of the precious seeds, under a small dome. The oats were the first to sprout. Then the hardest of the other grains showed signs of life.

The slow germination wouldn't have made him happy a few months before. Now it was a marvel to watch the seeds show life at all!

Light, which filtered through the overhead ice, was so dim it would have been considered twilight, compared to the bright sun. But men's eyes had become accustomed to perpetual twilight, and they were able to read during midday.

ALL OVER the world the same phenomenon was taking place. Ice caves appeared around every habitation. On the big mid-West farm the cows were turned into the caves to pasture. The cattleman had been prepared to face the worst with a smile. Now things were changing, and life looked brighter.

One of the hired men brought forth a guitar, and music was heard for the first time in months of confinement. They were happy. Life might not hold the same round of pleasures as before the ice ended an era, but they could go on living. Perhaps some day they would find a means of cooking their food once more!

After a month, with the cows pastured in the caves, a strange cow appeared in the Westerner's herd. Two hours later, while they were still trying to solve the riddle—the owner came looking for her!

It was the first reunion of neighbors in the new life. They sang and danced, to find other people alive in a world they had thought uninhabited. It started searches for other people, who might have lived through, and could join the community group.

Two of the hired men started shaving every day, and kept their clothes brushed. The neighbor had a daughter—and they hoped to go calling. Life was worth living again.

ONE DAY a man walked into the house of George Doolit. At first they couldn't believe it. The Doolits had thought themselves alone in the world.

He had wandered nearly ten miles, lost in the caves of ice. There were wonderful stories of the formations of ice, and some tragic ones of the sights in deserted farmhouses.

There were no signs of life in the houses he passed on the trip, and hope was given up for the survival of others in the section. But other things gave hope of prolonged existence. Ice caves, with ceilings twenty feet above the ground, had luxurious grass beneath.

Ice blocks, that could support any amount of weight, were bridged between by the domes. Where the ice stood in pillars, there was no sign of thawing, and it gave hope the domes and supports would become permanent.

The stranger stayed three days, before trying to retrace his steps. It was pleasant relief to know they had a neighbor, even ten miles away.

George Doolit found a compass to guide Morley Little back to country he was familiar with. The only stock Little owned was one cow. When he was presented with two hens and a rooster—the strong man trembled. It meant more than the present of a new farm could have a few months before.

When Morley started for home, George accompanied him part way, examining the formations of the ice care-

fully and extensively. At spots the domes were larger than he had seen, but the supporting pillars appeared massive enough to hold whatever weight bore down on them. Some openings close by were large enough to make cultivation seem practical, and Doolit examined the soil critically.

Returning, he continued his exploration for crop land, and three days later some of his seeds were planted. Fresh food was in prospect! Even if the crops did not grow *well* without sunlight, they still showed life enough to warrant hopes of a harvest. The few tests he had made had all resulted in sprouts, sickly, but more precious than growing gold.

A little judicious chopping and Doolit had an open passage between the barn and his cultivated fields. He started plowing and preparing for a future different than any living man had ever dreamed. There seemed to be no sub-surface frost.

Potatoes were his last worry. They had been packed away for two years and the majority had rotted. But some still showed live sprouts. With good luck he could grow enough seed for a fair second planting, and have a few to eat. That would be a delicacy! Doolit's mouth watered at the thought of fresh boiled potatoes; then he frowned. Unless some unforeseen method of cooking could be devised, they would have to be eaten raw. But even that sounded mighty tempting.

There was too much moisture in the ground for the good of normal plants, but Doolit had to take the chance of success. It was the middle of July before all his crops were in the ground, and he feared the seasonal effect of winter, even through the ice.

The moisture did not seem to retard the crops as he had expected. Even the chill air did not retard them. They shot up at an amazing rate. Night and day the temperature remained the same, and

growth seemed to maintain an equally even pace. This rapid growth and maturity seemed to absorb the bad-effects of the excess moisture in the soil.

Each new-found obstacle seemed to create some new advantage. In the steady temperature, the coolness seemed to be compensated by the warmth held in the earth itself. The plant life seemed to adapt itself rapidly to the changed condition of nature. It grew as rapidly and firmly as once young plants had grown in cold frames. Some crops were stunted—but they were hardly for all that.

LETTUCE AND RADISHES were on the table by the middle of August, with other crops growing fast enough to satisfy any farmer.

By the end of September great caves thirty feet high, covered many of the crops. But the supports showed no sign of weakening. The ice had almost stopped melting, but the atmosphere remained comfortable. The intense cold above, and the natural heat of the earth below the ice, were reaching a deadlocked balance on the process of thawing.

A quarter of the land was clear for use. The survivors of the ice years looked forward to farming under strange conditions. At times the ice overhead rumbled and seemed to shift slightly. But men became accustomed to the sound and ignored it. Only when pieces of ice were dislodged and fell, was their attention directed upward for a passing glance. They were too busy to spend time worrying.

The overhead ice showed no sign of softening; even where the domes were highest. Light still filtered through in the faint radiance of twilight, over everything, without increasing or lessening

during the daylight hours. When the light faded out, men knew that the sun had set.

Several thousand people throughout the world had started to rebuild their lives to fit the changed conditions. Many more had survived than any single group of survivors dreamed. In places one group would be unaware that other men still existed. But they traveled farther from home all the time. Every once in a while strangers met, to rejoice in the good fortune of each other.

The world had changed. From other planets it appeared lifeless. Alien scientists would be sure nothing living could exist in the intense cold which had frozen the very atmosphere to give the globe a shining cover; to them it was dead.

But within the surface of the frozen sphere, men toiled in the warmth radiated from its heart. To *them* it was still home. Instead of rain, dense fogs drifted through ice caves. Moisture gathered and fell on growing crops, which prospered.

For everything the earth had taken from her people, she gave them something in return. She had mothered and matured the human race, and now was creating for it a new existence. Her children could live in some form of comfort.

Small trees (within the caverns) sprang forth in leaf beneath their crystal skies. There was no growing season. The weather did not change. Where once there were five months for growing crops, now there were twelve. And the yearly yield per acre was nearly the same.

Mother Earth had taken her work seriously and was caring for the last of her children.

What Is Interest?

Because we have been faced from time to time by fictional presentations which strain belief, I have arranged for an article on "Visitors from the Void," by Willy Ley. It is scheduled to appear next month—and it is factual data such as that from which story plots are evolved. There is something very gripping in the idea of life on earth which may actually have originated on Mars. Don't miss this article.

Suppose we have one fact—not absolute, but tentative—"Life exists on this earth—alien to earth." Are we not thus justified in developing all the science-fiction of all time logically from this one fact?

What wonders have been written by time itself in the geological formations of the earth's sub surface! A man can lose himself in the stories told by folds of rock and gravel, hard pan and limestone, sandstone and marble. He can forget civilization's puny accomplishments in the glories of architecture created by an ice age. He can forget time while his eye is fixed on the lens of a reflecting telescope—for the mysteries of other worlds draw nearer for a while.

Once man looked across a river. Then he rode a drifting log to the far shore. Then he tied two logs together and paddled across. Then he made a sail; then an engine—and last of all—a bridge.

To-day we're looking at the stars. Is it an idle dream to think that one day we shall cross the void?

Your letters this month have shown a perfect spirit of coöperation, and I thank you. Scores of letters have been written in two sections, one for Science Discussions; the other to help me rate the story appeal.

And there are some big things coming this year. The schedule is slowly shaping up for what will be the finest program in a long time.

Let's work hard to reach out for new readers now, while our magazine is pushing forward toward the most important period in the history of science-fiction. Thank you, I know you will.

The Editor.



SCIENCE DISCUSSIONS

AN OPEN FORUM OF CONTROVERSIAL OPINION

On to Atlantis.

Dear Editor:

I certainly would like to fire a couple of *tut-tuts* at Dr. Clark, Mr. Miller, and others who are pouncing on Mr. White with reference to Mu and Atlantis. Of course, their scientific refutation is unassailable; of course, Churchward hasn't a leg to stand on, scientifically speaking; and, of course, Churchward knew it. But Churchward could write fiction with such a punch that it stood up, and aroused the interest of even the soberest of the academicians. The *Lost Continent of Mu* was so well done that every speculative, intellectual optimist hailed it with delight and wanted to believe!

I doubt if even the Clarks and the Millers escaped the contagion at the outset, even if they have since won their immunity by resort to rigid scientific procedure. One can only guess at their inceptive vulnerability by the measure of the recoil evidenced in the eagerness with which they rush to the attack upon one who is not emancipated.

Naturally, we would all demand more evidence concerning the finds supposed to have been made by Frank Nivens in the clay pits north of Mexico City. The long line of Hawk kings, the prehistoric Menes, and the five-thousand-year-old civilization of Ur certainly contradict Churchward's idea of the colonization of Egypt, but on the other hand, the claim that the first invasion of the Americas came by way of a land bridge where the Aleutians are now is not completely established by any means. There is no evidence, as yet, to show the progressive spread of culture from that direction. (Positive statement made to me by an anthropologist of highest repute.)

Churchward made excellent use of the cliff-dweller writings. A map of the Colorado River system, spotted wherever a cliff-dweller carving is known to be, looks exactly like a cherry tree, with the Colorado itself as the trunk, the tributaries as branches, the small feeder streams as twigs, and the dots representing the writings as the cherries. The picture is inviting and plausible if one wants to believe that those people

came into the river by boats and kept on traveling until their small boats could go no farther, so that debarking, they made their inscriptions.

For another matter, the antiquity of man on this continent is not yet finally and indisputably settled at either ten or twenty thousand years. Personally, I like to think of the finds in the Trenton gravels as indicating a paleolithic population ranging from thirty-five to fifty millenniums. The Eskimos may have come to people the frozen wastes by following the retreating ice cap.

As for dinosaur pictographs there is nothing incredible about the existence of at least one. They could have been devised from a well-preserved skeleton.

And I notice that the denouncers of the Churchward hypothesis are having nothing whatever to say about the world-wide, coastwise spread of the Heliolithic culture—a matter which aroused the interest and curiosity of H. G. Wells so greatly, and which still (scientifically) lacks a truly satisfactory explanation.

One or two of the specimens of picture writing, which Churchward reproduced as presenting the story of a migration of the people of Mu after the destruction of the continent, are peculiarly intelligible if closely studied and seem to bear out his version, but there may be very grave doubts cast upon the great antiquity which he ascribes to them.

In summary, I recommend that the disbelievers, since they have said virtually all they can, should refrain from making a scientific presentation, but, on the other hand, should not persist in the peopling of the continent, at any time or source, has

like the aborigines indeed, have gone to time as the redmen and possibly from the same place, though it is not necessary to assume even that. The Peking skull is so very, very old that conjectures as to the spread of the human race are almost boundless. The Mu or mouth sign was incorporated in the original form of the Japanese Gateway to Heaven (at the double-barred top). That is one item that Churchward overlooked.

Yours, congenially, for tolerance and mild attacks—I mean like the suave comebacks of Mr. (or is it Professor?) Campbell.—Emory L. King, 430 Main Street, Ridgefield Park, New Jersey.

The Check-off System.

Dear Editor:

Although I have been a faithful reader of every issue of *Astounding Stories* for the past three years, this is the first time that I have availed myself of an opportunity to write a letter of criticism to you. To begin with, take Brass Tacks (or Science Discussions, as you will):

August, 1936—J. H. Pfnsohl:

You are correct in stating that the temperature of Jupiter and Saturn is about 200° Fahrenheit, but I must take exception to

“it has been conclusively proved by spectroscopic analysis—as in the cases of Jupiter and Saturn—that the carbon-dioxide content of the Venusian atmosphere is many thousands of times that of Earth’s.”

On what authority do you make such an utterly ridiculous statement? In the first place, Venus shines only by reflected light, ergo, her spectrum would only show elements that occur in the Sun. In the second place, it is impossible, under present conditions, to ascertain what elements occur in the Venusian atmosphere, due to the thick veil of clouds.

October, 1936—L. A. Kennedy, Jr.:

You laud *Spain of Eternal Thought* and *The Cometeers* and then tell Lovecraft to “—quit writing until he can create characters and action like Weinbaum and Williamson.”

Silly, stupid criticism. My dear boy, there isn't anything blood-and-thunderish about “*The Fall of the House of Usher*” or “*A. Gordon Pym*” or any others of Poe's horror tales. Yet, they are considered to be classic short stories. Lovecraft's style is modeled after that of Poe. He weaves about his characters an aura of horror that lingers long after the story is ended. I consider him to be the premier pulp writer.

On the other hand, just what is so hot about Weinbaum or Williamson? The former (I'll probably get about twenty trinitrotoluene bombs in my next mail for daring to ostracize an author who is unable to defend himself) depended entirely upon love interest to formulate his plots. The “Ham Hammond” series is merely a twentieth-century love story in twenty-second-century atmosphere, with some slap-stick burlesque included for good measure. The latter's stuff is even worse. I have yet to see a story by this author that is without love interest. Science? He couldn't tell the difference between a ring nebula and a positron.

November, 1936—Thompson:

Pardon me, but I must correct your statement. “It is not known whether the temperature on Jupiter is very high or very low.” Who told you that? I'd like to know, so that I can give him a verbal kick in the pants. I refer you to “*The Universe Around Us*,” by Jeans, p. 20 “—the temperature of Jupiter is about 150° Centigrade, which is just about that which would be maintained by the Sun's sheet alone.” Also, “*Consider the Heavens*,” by Forest Noy Moulton; after explaining that life on Jupiter—this is on p. 92, by the way—would be an impossibility due to the terrific cold and “—the turmoils that exist in the atmosphere would destroy organisms of any considerable degree of complexity,” he goes on to conclude that “—on the Jovian planets there is no life.” (This, incidentally, refutes Herr Campbell's theory in the February, 1937, issue.)

December, 1936—L. S. Kirton:

“Science features such as John W. Campbell, Jr., is now giving us are so far superior to *Fortes* that a comparison can hardly be made.”

When I read that statement, I threw the magazine down in disgust. It is the very personification of inanity and inconsistency. *Lo!* was not meant to be perused by ten-year-olds whose knowledge of science and logic came from “Buck

Rogers” and “Flash Gordon.” It's not easy reading, I grant you that. But if you don't understand it, don't criticize it. As Hubert Allcock so aptly put it: “Dogmatic smugness is a fine armor in which to sheathe ignorance or stupidity.”

By changing the word “superior” to “inferior” you will approach the truth closer.

January, 1937—M. J. Lyons:

“That little wheel” does *not* turn by light pressure. Light is far, far too tenuous to exert any appreciable pressure. The radiometer—for that is the name—turns because the white side reflects the *heat* of the sunlight and the black absorbs it. Reflection and absorption occurring alternately, the wheel turns.

February, 1937—Dr. Clark:

While I am in accordance with the main thesis of your epistle, namely, that Mu and Atlantis hypotheses are fiction, I must, however, animadvert some minor points which you brought out. Firstly, Madame Curie was not “hailed” for her monumental work. True, a few recognized the true value of her discoveries, but in the main, the great bulk of the Paris graybeards frowned solemnly upon her “radicalism.” It was only after she presented incontestable proofs of the validity of radioactivity that her theories were reluctantly accepted.

You also say that Darwin escaped the criticism of his fellow biologists. This is not so. With the possible exception of the church, there were no more virulent enemies of Darwinism than the biologists. Witness the rise of “Neo-Lamarckian” school and Sir J. W. Dawson's attacks on evolution.

In re Dr. Rhine, well, is there anything radically new about mental telepathy or clairvoyance?

In all fairness, however, I must admit that there is no conclusive evidence for or against Lemuria, Mu and Atlantis. It can be likened to the hypothesis of a god—one can neither prove nor disprove it. One can only advance arguments supporting or attacking it.

Just what is the reason for all the delight at the prospect of a new name for the readers' department? You can call an onion a rose, but it would still remain an onion.

In conclusion, I might say that I do not read *Astounding Stories* for the science that is contained within its pages. I get a tremendous guffaw out of the letters that commend *Colossus* or *The Legion of Space* for the science in them. —Peter Duncan, 45 North First Street, Paterson, New Jersey.

Completing the Information.

Dear Editor:

Science Discussions is an excellent idea. It should prove most popular with your many readers.

For the past three or four months there has been in some of the letters to Brass Tacks the question, “Does lightning strike upward?” Several answers have appeared, none of them, however, being correct. Mr. Chernoff just had his facts twisted.

Research scientists have found that a display of lightning consists of two parts: a main flash which is preceded by a leader. The leader travels from the cloud to the earth at speeds up to seven thousand, two hundred miles a second, and is unbranched. It consists of a great number of electrons which ionize the air, making it electrically conductive, and thus paving the way for the main flash. As soon as the leader strikes the ground, the main flash starts upward along the same path, reaching a speed of thirty-four thousand miles a second. As the main flash ascends, it often casts out branches which point to the earth, giving the erroneous impression that it is directed downward instead of upward. The apparently single discharge may consist of as many as ten double flashes.

I hope the above explanation of a lightning phenomenon will clear up any misimpressions of the readers.

Can any of the amateur chemists supply the

atomic weights for actinium, dysprosium, europium, holmium, and polonium?

Mr. Fearn's *Metamorphosis* was very good, but how could Gordon Wood and Nick Easton be kept busy answering telephone calls when the city's supply of electricity had failed?—Wilbur J. Widmer, 679 Park Avenue, West New York, New Jersey.

Protection from Solar Radiations.

Dear Editor:

If I have enjoyed Astounding Stories before, I am overjoyed now. Upon buying the February issue and seeing its wonderful cover, more stories in the contents and Science Discussions inaugurated, my feelings and gratitude knew no bounds for what you have so far so excellently accomplished.

Now for a problem: 'Tis known that a layer of very thin ozone protects the life of this planet by filtering out deadly radiation from dear old sol. Now, a space ship venturing into space would subject its occupants to this harmful radiation. This factor must be taken into consideration before space can be conquered safely.

My solution consists of a narrow space between the outer hull and an inner hull filled with ozone in sufficient quantity to protect the travelers.

If any one has a better solution, I wish they would present it, and if any faults are found with mine, please inform me through Science Discussions, if our editor so decrees. Another problem next time. A faithful and grateful reader.—James Gardner, Jr., White Sulphur Springs, West Virginia.

Read the Next Two Letters.

Dear Editor:

Tsk, tsk, shame on you, do you really think the batch of letters in back of the February magazine deserved the title of Science Discussions? It's disgraceful. It started excellently with Dr. Clark's long letter, but with the exception of a few scattered items, it was the same old Brass Tacks.

I read and enjoy Astounding every month and for those that don't, why do they buy it?

I'm not much of a scientist, but while reading Jim Blish's letter, I thought of this: A one-dimensional line is invisible to us because of its lack of breadth and thickness, but we can think of it as an imaginary line because that is not wide or thick, but only long. We can think of two dimensions as an imaginary plane. When we think of either, there is an imaginary line where we think it, so why couldn't the third dimension be merely the thought of a four-dimensional creature? I would like to hear some one explode this idea if he can.

I end my epistle with a few questions, namely: Does lightning strike up or down? When and if you answer, give scientific proof (no formula, though). Why is space black? It seems to me it should be a continuous glare, as there is nothing but ether to stop the rays of the sun and stars.

Best of luck for you and the magazine.—David Charney, 150 Haven Avenue, New York, N. Y.

One Answer.

Dear Editor:

I have been a reader of your magazine for some years, but have not thought of writing until reading Mr. Chernoff's outburst in the December, 1936, issue.

To proceed, may I correct the above "author-ity"?

1. The initial flash in lightning referred to is not a flash, but a stress on the electrons of

the dielectric (air) gradually leading to a breakdown. (McFarland's "Electrical Engineering.")

2. Unionized compounds do react, notably in organic reactions, i.e., formation of an ester $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \rightarrow \text{CH}_3\text{COOC}_2\text{H}_5$. Water retards the reaction by LeChatelier's principle.

3. The ether (or aether) concepts have long been thrown overboard by most physicists. So space can very easily be considered a vacuum.

I hope Mr. Chernoff will be more sure of his facts before setting himself up as an authority.

—R. J. Bibbero, V.C. '38, 2250 Piedmont Avenue, Berkeley, California.

Submarine Intelligence Possibilities.

Dear Editor:

Despite the fact that I was represented, the first taste of Science Discussions pleased me very much. With the excellent answers to Mr. White's letter, it is only fair to say that his was a very fine essay, made doubly valuable with the confutations. He cannot be reached by mail at the address given.

Mr. Blish's letter regarding dimensional possibilities has interested me very much. Hoping that the practice of an old fellow in Syracuse might help me, I floated about in a tub of warm water for an hour, and as a result experienced some very interesting reflections on the subject of spatial dimensions.

To eyes capable of recording three dimensions, a solid of four dimensions would appear only as a three-dimensional object. Were beings of the fourth dimension to build a device in the shape of a tesseract in which to pass into or through a three-dimensional space, the tesseract would manifest itself to denizens of three-dimensional space as a cube. Analogically, three-dimensional optics could perceive nothing in a two-dimensional world.

Granted that human beings could undergo a revolution into additional or less dimensions, only three-dimensional appearances would register. But it is probable that in this hypothetical revolution, changes would take place in objects of three dimensions to make their properties those of four or two dimensions. Paul Ernst, in "The 32nd of May," painted a fascinating picture of a man's encounter with two-dimensional entities.

Mr. McClary counts much, in his article on deep-sea farming, on the use of the electric gun. These so-called electric guns would operate, I suppose, on static electricity? If so, they could be focused in no manner that I can see. By some obscure method or device, a powerful charge of electricity is stored, or potentially so. When that is released from the weapon or tool, it will strike the nearest object bearing an opposite charge. I think that is correct. What, then, would be its utility, other than as a variation from the usual means of suicide?

I found *New Frontiers* very excellent, and very interesting. I thank the author for his (to me) ironic comments on the building of new fortunes, the deep-sea czars. I hope that political evolution will have reached a stage, by the time that the seas are being exploited, wherein the products of the ocean floor will be used for the advancement of mankind as a whole.

Also, let us hope that the new frontiersmen will exercise the imperative practice of conservation. Mr. McClary did not mention that. Man's disruption of the natural balance on land has brought most unfortunate results already to us in the United States, and the worst has yet only begun. When man looks to the ocean floor for sustenance, may he farm it carefully, conservatively, to the advantage of the generations to follow!

And again about the ocean depths: I have always believed in almost probable existence of intelligent beings in the deeps. True, no evidence of such has been found, but man has dipped but little beneath the surface of the seas. In the vast world of terrific pressure a mile or so down, who can say to what extent submarine life has developed? Who can know? Conditions

will not allow investigation on our part, or that of any possible highly evolved beings there, but it is a source of much speculation.

Most of your authors, when treating the subject of the basic quantities of the universe, regard intelligence as most important. Energy, matter, intelligence, seem the accepted terms.

Schopenhauer, the German philosopher, entertained a belief which I find much more logical in the light of our knowledge of human evolution. His contention was that the root of all life, all evolution, the volition of organic matter was will. Will created intelligence as the control of matter, that the desires of the will might be attained. Intelligence developed, all evolution took place, because of the will. I think this a prime subject for argument, but whether the truth can be ascertained, I do not know.

My lack of elucidation has been a result of your wish for letters short and to the point. I hope that this has in some measure met your desires. Science Discussions is all that could be desired in a readers' department. I found it difficult to restrain answers to a too large number of subjects aroused even by the few letters in the first "number." The new department is the most progressive step ever made in a science-fiction magazine, and I am sure that you will find it most successful. Good luck!—Claire P. Beck, Stonybrooke, Lakeport, California.

Scoop!

Dear Editor:

Astounding Stories scoops "Coronet."

That is the headline that flashed into my mind when reading Ley's "Strangest Animals" in the January, 1937, issue of "Coronet." On p. 148 Ley states, in connection with several existing and extinct animals having three true eyes (and especially regarding the remains of this same third eye still found in humans):

"Oculists believe that there was a time when the predecessors of men—whatever they may have been—looked into the fourth dimension by means of this eye."

I say scooped because in your December, 1936, issue, the outstanding feature was Parker's *4th-Dimensional Possibilities*, and in that feature (on the stands 36 days before the January "Coronet"), was developed the theory that to properly see into the fourth dimension three eyes are necessary.

No wonder we are loyal to Astounding Stories; and it is gratifying to be able to point out to doubters such instances of "our mag" beating one of the snootiest of the slicks to the draw.—Robert Jones, Utica, New York.

Life on the Planets.

Dear Editor:

Your February number was very good; but what I enjoyed most was the article, *Other Eyes Watching*, by Campbell.

The author's thesis in favor of life on the planet Jupiter in spite of un-Earthly conditions was not only excellently presented, but it brings up the fallacy of the reiterated theories of astronomers that life apart from the Earth's is highly improbable because of the scarcity of planets in the universe; the improbability of life on such planets—if they exist—because of different physical conditions.

Campbell presents a good case against the latter.

As for the astronomers' premise that very few planets—if any—exist outside of the solar system (Sir James Jeans holds the possibility of such worlds are one in millions) it might be well to call attention to double, triple, and multiple star systems, which, in the final analysis are comparable to planetary systems. Multiple star systems—and by this I mean binary and other systems whose component stars are separated only by solar distances—are legion. At-

most one third of the stars studied belong to this type.

Surely, if the great number of these systems are considered, the possibility of planets is not so remote. For one thing, the tidal actions of stars in a binary system could easily result in far-flung debris which might condense as planets. (See origin of solar system.) And then, in multiple or binary stars, it stands to reason that the smaller or less radiant stars would cool more quickly than the larger and become in every sense of the word—planets.

Astronomers admit the existence of dark stars. Why not dark stars, i.e., planets, in multiple systems, near enough to "brother" suns to benefit by the heat of the yet incandescent stars?

It seems to me, taking this into consideration, that life is not only possible, but probable in other corners of the universe.

I have never seen this theory advanced as such, and believe it would be of interest to readers of Science Discussions.—Samuel Gordon, 1513 Upshur Street, N. W., Washington, D. C.

The Colloidal Process.

Dear Editor:

My first attempt, and I hope I'm successful in getting this into print.

More power to Astounding and Science Discussions. How about two hundred pages? You have the best magazine on the market now, but how about making it forever unbeatable?

Me? I'm a scientific fanatic, to be truthful. I'm interested in chemistry especially. Every morsel of scientific interest that I can sink my teeth into, is gobbled greedily and tucked away in the void in which I think a great brain reposes. Enough of this. By the way, do any promising young chemists at the age of nineteen wish to do a little corresponding?

A party residing in New York and myself have recently been slamming theories and experiments back and forth via Uncle Sam's mail route. In his last letter he failed to give his new address to which he stated he was moving. I'd like to use Science Discussions to answer him. Perhaps the following may be of interest to other readers.

Hi Andy:

Here is part of the information you requested concerning the colloidal gold extraction process: You would find this if you looked up data concerning colloidal particles. These particles are in suspension in liquids. They are prevented from settling by a vibratory motion, visible in the ultramicroscope, that is known as the Brownian movement. Dispersions of coarse particles do not show this motion.

The reason is probably as follows: The molecules of liquids do not move with equal velocities; a particle suspended in a liquid may, therefore, be unequally bombarded on its opposite sides by the moving molecules of the liquid. If the suspended particle is relatively large, the inequality of the bombardment will be negligible in comparison with the mass of the particle, and nothing will happen. But if the suspended particle is small, the unequal blows of the liquid molecules will be sufficient to set it in motion. So dispersions of fine particles will not settle because they are thrown into Brownian movement. This motion is the most characteristic thing about colloids. Any substance can be put in colloid condition by producing particles that are small enough to experience the Brownian movement.

The latter sentence is the key. As you know, as years go by, rocks, minerals, etc., are worn down smaller and smaller. If ordinary sand found in Nebraska is washed, no gold is found, but if the sand is thrown away and the water kept and treated, it can be found. The water is placed in a specially treated tank and electro-lyzed. The particles of gold suspended in the water lose their former positions and enter a piece of mercury placed in the tank. The mercury is eaten or retorted off, leaving the gold

button. Under a microscope one can see hundreds of particles forming the button. These particles themselves are composed of thousands of particles invisible separately.

I guess that's all I have to say, except that I want to be enrolled in the list of devoted readers.—Francis Jensen, Central City, Colorado.

The Outside Does Cool First.

Dear Editor:

I have just finished the February issue, and wish to congratulate you on it. It was excellent! The stories were uniformly good, so I will remark on but two. The first is *The Saga of Pelican West*. It was rotten! However, it was the only really bad story in the issue. It had a bad title, revoltingly horrible (literally) descriptions, did not explain the queer visions, and was silly. The only halfway decent thing in the story was Alfred, who was amusing, though obviously copied from Weinbaum's parcat. The other story is the one by Kruse. I was very pleasantly surprised with that yarn. Kruse has improved 100 per cent.

I like your new—er—slogan: "160 Pages of Science-fiction." Here are some things I wish you'd do. First, radical though it is, I really believe it would be an important change for the better if you would change the title of the magazine. It sounds trashy as it is. Because of it, I'm really ashamed to be seen with the magazine! Have a title more dignified—something with the word "science" in it.

Second, have the magazine in the large size. It is more dignified, puts the magazine with the higher-class "slicks," and permits better illustrations. And get Frank R. Paul! He's a real science-fiction artist, with a wonderful imagination. How about a Wesso cover? And last, but not least, *quarterly, please!*

Science Discussions is excellent. Glad to see the new heading. But I still want Brass Tacks, in addition. Jim Blish's letter gave me an idea—maybe new, maybe old. He states that since a three-dimensional thing is made up of an infinite number of planes (two-dimensional), it would take a two-dimensional being an infinite time to see it; consequently, a two-dimensional being could not see anything three-dimensional. Of course, it is understood that there are other reasons why it could not. Now, here's my theory: If Mr. Blish is right—and he seems to be—it would take a three-dimensional person *almost no time at all*, to see anything two-dimensional, so he could not see it at all! And that, too, is only one reason. Extend the idea; four-dimensional beings cannot see us.

In that excellent article, *Other Eyes Watching*, the author makes what seems to me to be a big mistake—yet a very simple one. He states, "The core grew cold, as the core of all other planets had cooled." I may be wrong, but I've always thought the outside cooled first, which accounts for volcanoes, etc. In fact, I'm positive of it. Yet it seems strange that such a well-informed person as Mr. Campbell should make such a mistake. Well? Also, he should have discussed the Great Red Spot. But, as I said before, the article was excellent. I really pitied the Jovians at the end.

Has the Black Hole of Cygnus (*Beyond Which Limits*) any connection with the Horse Head Nebula? The latter is obviously *not* a hole in space—any good photograph of it shows that. Also, in connection with *The Comet*, is there any such thing as the Deveraux Wind?

I note, with gladness, the increasing science content of the magazine. *Beyond Which Limits* and the announced *Dawn of Conquest of Space* don't seem to mean anything—the titles, I mean, of course.

How about a new Lovecraft serial? He's one of my favorite authors.

Maybe this letter exceeds the one-thousand-word limit—but I doubt it very much. If it doesn't, I hope you publish it in Science Discussions. If not—I'll try again.—Paul H. Spencer, 88 Ardmore Road, West Hartford, Connecticut.

A Shadow by Rotation?

Dear Editor:

Congratulations on the February issue. The cover was excellent. Brown seems to get better with each painting. This is the first letter I have written to you, though I have been reading *Astounding Stories* for one—two—three—years. I really don't know. The first issue I read contained the first installment of Jack Williamson's story *The Legion of Space*.

The magazine has progressed steadily upward since then.

At the Perihelion, by Robert Willey, has introduced a new method in space travel, in separating the front from the rear and keeping them connected at a distance of three miles by means of a cable. But a terrific centrifugal force would be exerted on the cable, so that I don't think that the idea would work out very well practically. The story was, however, well-written.

The Saga of Pelican West was swell.

The concluding part of *The Blue Spot* was a fine finish to a swell story.

All the other stories were O. K.

Mr. Parker, of all the letters, said that a one-dimensional object would cast either a one or an O-dimensional shadow—by rotation. Mr. Parker is wrong here. The one-dimensional object would cast a one-dimensional shadow but *not* an O-dimensional one. I agree heartily with Jim Blish, of East Orange, N. J., in his arguments against Mr. Parker.

Has that controversy over some point in the story *Irrelevant* been settled, or did the battlers run out of facts?

Give us two hundred pages and charge twenty-five cents. See if I care; I'll still buy the magazine.—Arnold Anderson, 1204 Boynton Avenue, New York City, N. Y.

Rocket Reactions.

Dear Editor:

I hope that you are not getting disgusted with me because of the numerous letters that I have sent you, but the first Science Discussions prompted me to write. Several questions, etc., that appeared in the pages have been the chief cause of the letter.

An answer to a theory presented by a certain James Taurasi, and which you labeled, "Rockets Need No Resistance," will be my first topic. The heading that you put above the letter is entirely correct. When we think of a rocket in flight, we easily see that in the firing chamber there are four directions of impact to be considered.

First: when the fuel is ignited it shoots out the opening with a high rate of velocity. Of course, out in space there is nothing for the gasses to react against, hence a total loss of energy.

The second and third reactions are against the sides of the firing chamber. The "push" in this instance neutralizes itself.

However, the fourth reaction is the one that we are interested in. This impact "pushes" against the front wall of the firing chamber. In space this is the force that moves the rocket. As a matter of fact, it is this force that is largely responsible for the experimental flights that have so far been quite successful.

Now, in answer to the queries of a certain Milton A. Rothman, who asked the following question: Should the science in a story be sacrificed for the plot? I think that it should run about fifty-fifty, as a typical interplanetary story wouldn't be interesting.

In some stories the "swampy marsh/lands of Venus" have been mentioned. That, of course, is erroneous, as Campbell showed us in the September issue. That sort of mistake should be curtailed. That is about all that I can think of to say, except that the February issue was *ultra ne plus ultra*.—T. B. Yerke, 157 N. Alexandria Avenue, Los Angeles, California.

Atlantis Bibliography.

Dear Sir:

May I take this medium of expressing my pleasure and astonishment at the perfect deluge of mail which greeted my rather long-winded Atlantis letter in the December Astounding. To those myriad gentlemen who were kind enough to show interest in the stories of Atlantis and Mu may I state that it is impossible for me to answer each letter individually, although I intend to do the best I can with those who inclosed stamped envelopes for replies.

To those who suggested that I do an article about Atlantis, may I state that while such an article would, in my opinion, be a boon to those of us who are interested in this fascinating gap in the world's history, still I am dubious as to the commercial value of such an article in the science-fiction field, and I am afraid the editor would agree with me. After all, real imaginative fiction is what Astounding fans want, and any article of mine would make pretty dry reading for the most of them.

The universal cry in the letters I received was this: "Where can we get books which will give us the information you seem to have at your finger tips?" The real purpose of this letter is to furnish a blanket reply and give a list of the sources of my information and, in so far as possible, the publishers. The list is far from complete, but if it is acquired, it will give the reader a very comprehensive knowledge of all that is known of the lost continent of Atlantis and Mu, the motherland of all mankind.

TITLE	AUTHOR	PUBLISHER
Atlantis in Andaluca	E. M. Whishaw	Rider
Atlantis and Lemuria	R. Steiner	Anthroposophic Press
Search for Atlantis	E. A. Bjorkman	Knopf
Story of Atlantis	W. S. Elliott	Theosophical Press
Deluged Civilization of the Caucasus Isthmus	R. A. Fessenden	Massachusetts Bible Society, 111 Bromfield St., Boston
Atlantis in America	Lewis Spence	Brentano
History of Atlantis	Lewis Spence	McKay
Problem of Atlantis	Lewis Spence	Brentano
Atlantis	G. T. Hauptmann	Viking
Atlantian Continent	H. E. Forrest	Witherby
Atlantis	W. R. Berbaum	Meador
Lemuria	W. S. Cerve	Roslorician Press, San Jose, Cal.
The Lost Continent of Mu		
The Children of Mu	Col. J. M. Churchward	Washburn
The Sacred Symbols of Mu		
Atlantis—the Antidiluvian World	Ignacius Donnelly	Harper
Relacion de la Cosas de Yucatan	Diego de Landa	
Queen Moo and the Egyptian Sphinx	C. E. Broseur de Dourbourg	
The Golden Age	A. LePlongeon	
Dawnland Man	H. J. Massingham	
The Children of the Sun	H. J. Massingham	
Gods and Men	W. J. Perry	
Myths of Pre-Columbian America	W. J. Perry	
The Hittites	D. A. MacKenzie	
In the Beginning	A. H. Sayre	
Pre-Historic No. America	G. Elliott-Smith	
The Buddha of America	McGee & Thomas	
	J. Leslie Mitchell	

In conclusion, may I state to those who suggested the formation of an Atlantis club to study the subject and seek to place it in its rightful place in the world's history, that I think it is a grand *idea*. While I haven't the time nor the ability to organize such a national project, I am hoping that some one or group of our Atlantis fans does and will, and I will gladly cooperate with such an organization and give any help or suggestions that I can. So, let's start the ball a-rolling. I'm sure Astounding will cooperate with us at all times in the matter of publicity.

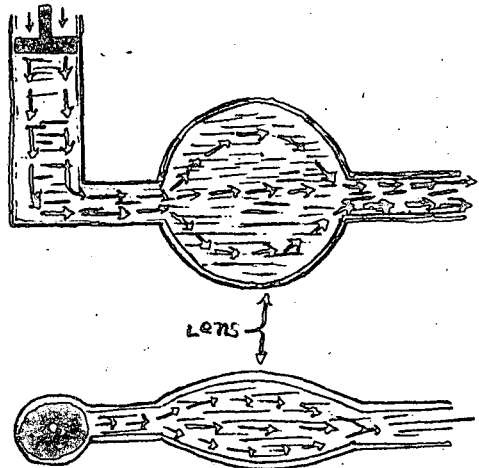
Just one more word and I'll sign off. I desire to thank the worthy Mr. Tremaine for devoting so much of his valuable space to my letter. Generosity such as his helps to make Astounding so outstanding in its field. I also desire to thank those whose amazing response to my letter has shown me the latent interest which can easily be aroused in the subject of Atlantis. May I prophesy that within twenty years the story of Atlantis will appear in our schoolbooks and

histories, no longer a myth and fairy tale, but an accepted and proven *fact*.—James A. White, 436 So. Topeka, Wichita, Kansas.

Answer to "The McGee."

Dear Editor:

In answer to "The McGee," this is the information which I received from a man that I know. If you will use a hollow glass lens and constantly pump cold water through it, you will find that it will stand the heat. Thus:



I hope this information will help "The McGee."—William Moffatt, Box 205, Centerville, Massachusetts.

To "The McGee":

I am very sorry, but it is impossible for us to publish letters which do not bear an authentic name and address.—The Editor.

A Question of Momentum and Light.

Dear Editor:

Your last two editions of Astounding Stories have put me on such an edge mentally that I have started writing an Astounding story myself. It really started in my mind about seven years ago, when I first read one of these kind of stories.

But the real reason for writing you is to find out if you could answer a little question which is probably easy to answer, but has me stuck. My story is partially based upon this one question, and if the answer is what I think it is, I am going to have to change my story a great deal. Here it is:

If an object in space moves toward you at a speed greater than light, will the object, a star, throw any light ahead of it at the speed of light?—Robert Jones, 401 N. Avenue 57, Los Angeles, California. The World of Purple Light greatly interested me and am hoping for others like it. But the story *Trust in Time* seemed like so much crazy talk.

Weight and Inertia.

Dear Editor:

Concerning the serial *Infra-Universe*, a body that had no weight would have no inertia: thus, Jim Wentworth could have moved the mass of ore.

If the pressure of his will could move his

body, it would suffice to exert enough pressure to move the ore, unless the thought of weight made it have inertia to his mind. Otherwise he could have moved it with a finger. I may be sling a few bricks and matter that is in a very putrid state. I like Astounding Stories enough to spend twenty cents on it.—Holles R. Scott, Jr., 2310 Thirteenth Street, South, St. Petersburg, Florida.

Gravitational Reactions.

Dear Editor:

This should be written as an article, and were I even the poorest kind of an author I would submit it as such. As it is, I'll have to send it in the form of a letter to Brass Tacks and hope it will either be printed there or rewritten as an article.

It seems to me, most authors of stories pertaining to interplanetary travel and adventure make the same error. To quote a line found in practically all their stories: "Less hampered by the weak gravity of the small planet, their Earth muscles carried them fully 50 feet into the air. With a little practice in landing they were soon able to proceed in great leaps of 100 feet or more."

First—assuming a man weighing 180 pounds on Earth weighs only 25 pounds on the small planet in question. How far into the air can this man throw a 25-pound weight on Earth? If he could throw it 50 feet into the air, how fast would it fall? Need I give you these simple answers?

Second—if a man from a planet 1000 times the size of Earth were to come to Earth and leap into the air, he might reach 100-foot altitude, but—can you picture him floating down to Earth uninjured? Neither can I. The only way he could float down would be to have a body practically gaseous or, at least, little heavier than our air. Can you conceive such a body on a planet that heavy?

One thinks of the theory of a variant time conception. But this, too, will be found to be somewhat reversed, i.e. assuming the alien falls to Earth in three seconds, as timed by an Earthman; with a different time conception this may seem to be ten seconds to the alien. But—time conception (if variant) is relative to size in the opposite manner. It is hard to believe that to the alien, whose home planet would revolve in about a week of our time, our time would seem slower. To him things should move faster on Earth, instead of slower, as would be the case if, in his time concept, he floated to Earth. The whole picture should be reversed if a different time conception is taken into consideration. To the Earthman the alien's every move should seem slowed down.

If we were to find living beings on a tiny planetoid would you expect to see them moving about at the same time rate as we do? You would not. In all probability they would appear to us to be scurrying about like ants in an ant hill. But to them, their movements would be normal and ours would be extremely slow; even our fastest moves, such as jumping in the air. To them it may seem three or four seconds before we hit the ground, but to us, it would still be a fraction of a second, and I dare say we would be able to jump no more than the usual two or three feet.

As far as fiction is concerned, I think the jumping episode should be confined to one of two common-sense deductions: first, he jumps without thinking and finds himself thrown 50 feet in the air and is instantly killed when he hits the ground; or second, he can jump only about a foot more than usual.

I think this theme would make an excellent editorial or special-feature article, because the more one thinks about it, the more complicated it becomes. Thoughts arise such as: the relationship between gravity and time; between size and time. By time, of course, I mean conception of speed; such as our speed of electricity

being 186,000 miles per second. If an atom is an inhabited planetary system and their electricity travels 186,000 of their miles in one of their seconds, what is our electricity to them and what is their electricity to us?

Maybe I'm getting a little goofy from thinking about it, but so many conflicting thoughts arise from that man jumping 100 feet, I'm beginning to think there is a big flaw in our laws of gravity, somewhere, and when that flaw is found we will actually have one of those anti-gravity screens we read so much about.

Hoping to see my theory in print.—C. T. C., St. Louis, Missouri.

Science-fiction at the World's Fair.

Dear Editor:

This letter is written in response to the heading "An Idea for Consideration" above Mr. Michel's letter in the January Astounding Stories.

I have written you before about the desire of science-fiction fans to popularize this form of fiction, which, as you doubtless agree, is a form of fiction that can help to advance civilization and science. A very good way to do this would be to enter a science-fiction exhibit at the next World's Fair in 1939.

My suggestion would be to hold a symposium on the advantages of science-fiction to civilization as the main feature. The discussion would be by noted authors of science-fiction, who are also scientists. Stress should be laid on their scientific background, so as to impress the public with the spirit of true science-fiction. Such men as E. E. Smith, Ph. D., J. W. Campbell, Jr., Ph. D., and Eric Temple Bell, professor of mathematics, should be enlisted in the cause.

Other minor attractions would be models and photographs of articles written about in science-fiction and perhaps a house of the future. This house could be made from glass, through the co-operation of some manufacturer.

The cost of this project should be financed by Street & Smith, as it is owing to their efforts that science-fiction has reached such a high standard. Their magazine, Astounding Stories, is the leading apostle of science-fiction, and the publishers ought not to hesitate to advance this type of literature, the most benefiting type to mankind that they publish.

Whatever the exhibit, and however it is financed, I believe that an exhibit in the next World's Fair would be the best way to popularize science-fiction. Don't you think that you ought to publish some sort of voting coupon in Astounding Stories and see whether the other readers think the same? You could see if they would contribute to the cost. I know I would gladly.

Before I close, could you tell me whether the Weinbaum memorial volume has been distributed? I sent my subscription and received a notice that I would receive the volume as soon as it was published. So far, I have not received my copy. Thanking you for reading thus far, I am yours for the advancement of science-fiction.—Arthur Kazerman, 395 Cross Street, Malden, Massachusetts.

P. S. Astounding Stories is "tops" and is still going strong. Have a junior edition of Brass Tacks, with only the best letters. Make Science Discussions a major feature of the magazine.

The Scope of Science-fiction.

Dear Editor:

I like Astounding Stories, but I can't see why it shouldn't be much better than it is. Science-fiction is a great field and if you can make full use of it, you will have a really great magazine. In the past famous authors have written science-fiction—Verne, Flammarion, Poe and Wells

—and good work in this line has never stopped appearing; some of it in magazines devoted to the subject and some scattered through other magazines. I hope you will be able to present more and more of the good stuff that is produced.

You have had many first-class stories. Taine ranks high, not only because he is a good writer, but because he is a scientist by profession. The Binders and Murray Leinster have turned out fine stories and I was sorry to see your announcement that no more of Weinbaum's work would appear.

As I see it, the two most important things in a story, regardless of subject, are sustained interest and an ending that leaves a satisfactory impression with the reader. If you can get stories that have these things, I don't think the readers will care much whether the subject matter falls within their private definitions of the field of science-fiction. After all, science is as wide and various as human knowledge, and what makes a story or article scientific is not the choice of subject matter, but variety in your stories. Space travel seems to be recognized as the main theme of science-fiction, but there is an endless variety of other topics that can be used. Weinbaum's last story you published, for instance, was in biology.

A science-fiction story should present something that has never happened and make the reader feel, at least while reading, that it is possible and reasonable. The creation of this illusion of reality is very necessary but the more unreal the conditions introduced, the harder it is to maintain the illusion. After all, we poor Earthlings haven't even traveled to the Moon yet, and when the authors carry us out into space and destroy the universe for our amusement, they have to do a very good job indeed if they make us believe in it. Hence, I would like to see more stories connected with present-day life and science.

I read Brass Tacks first and I like the idea behind the change of title to Science Discussions. I am glad to see more science in the letters, but the title seems too formal and restricting. The letter department should be a meeting place for readers and writers with the editor as host. You should have some interesting but nonrestricting title associated with the purpose of the magazine.

I would like to make three suggestions for whatever they are worth: 1: Have a contest for a new title; 2: Get the author's reply when a reader criticizes a story on questions of fact or probability; 3: Sometimes let the authors explain the scientific background of a story or give curious facts they know in connection with the subject matter in the same issue with the story. —D. R. Cummins, care of General Delivery, Sacramento, California.

All in All, Favorable.

Dear Editor:

As this is my first letter to dear old Astounding, I would appreciate it very much if you would publish it. So far I have remained in the background, so to speak, and let every one else do the talking. However, I believe it is time I say a few words.

Well, to begin with, I want to tell you that I gave up reading three other so-called science-fiction magazines and now buy Astounding only. That speaks for itself, doesn't it? But wait, don't think you're going to get off that easily. I have a few bouquets to offer you, and also a couple of bricks to throw. However, in spite of these likes and dislikes, I believe I would continue to buy your magazine, even if it cost 50c per copy instead of 20c. Now for the bouquets.

I am glad you keep Brown on as cover artist. His paintings are really quite striking. I am also for Campbell's articles on the solar system. This is one of the best features of its kind you have run in a long time. To my idea the four best stories of the last four months were: A

Beast of the Void, by Gallun; *Godson of Almarlu*, by the same author; *Macklin's Little Friend*, by Guernsey; and *Infra-Universe*, by Schachner.

Now for the bricks:

The House that Walked, by Barnes, in the September issue, was written for a weird tale and had no place in Astounding at all. To my mind *Little Hercules* was also a story of this type, with very little science content. I have noticed, with some relief, that you have discontinued giving us names of stories to come in the next editions. Who wants to pick up their magazine and already know half of its contents before they open it?

There is one other thing which would do wonders toward improving your magazine: a new title lettering at the head of your stories. The one you now have seems ragged and inefficient beside the comparative neatness of the rest of your magazine. One other thing: Binder's illustrations for *Trust in Time* were very poor. I am sure he is capable of much better work than that. Flatos is improving, but has plenty of room for betterment. Well, I'm signing off this time. Yours for a larger and better Astounding. —David Dalie, 412 Bowen Street, Dayton, Ohio.

A Subject for Reply.

Dear Editor:

Here is my subject for Science Discussions: Since gravity depends on mass, and an object moving at the speed of light has infinite mass, would not a piece of metal the size of a man's thumb nail, traveling at the speed of light, be able to wreck the whole system by its gravity? —Gordon McGlashan, Box 564, Westmont, Illinois.

Another B. T. Letter.

Dear Editor:

Hooray for the January issue of our magazine! Good stories? Lots of them. Good illustrations? Lots of them. In fact, lots of everything good. Campbell's articles are swell. They are not like the usual flat, tasteless descriptions of the solar system. They are stories!

Even Fearn's *Metamorphosis* was pretty good. He is improving. I think some day he may be one of our outstanding writers. —Arden R. Benson, 4011 Emerson North, Minneapolis, Minnesota.

Explosion.

Dear Mr. Tremaine:

I have been reading your magazine for over a year. I enjoy the stories very much. I am submitting a problem which has been giving me food for thought. My problem is this—what would be the results if an irresistible force should meet an immovable object? Most answers received from this question are nonsense. I would like a real answer.

Another problem involving a little thought is the following: if a projectile with an intense beam of light being thrown from a powerful searchlight on the front of it were shot into space at the speed of light, which is 186,000 miles per second, the searchlight being set off at the exact time the projectile left earth, which would reach the surface of our satellite first? Although I do not profess to understand Professor Einstein's theory of relativity, I think I am correct in quoting from his restricted theory. Here he states that the speed of light is not affected by the motion of its source. Will some embryo scientist answer my problems, please? —Norman O'Connor, 125 Barre Street, Montpelier, Vermont.

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